

2007-1196  
(Serial No. 10/658,143)

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**UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT**

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IN RE PAUL LEW and JASON SCHIERS

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Appeal from the United States Patent and Trademark Office Board of Patent  
Appeals and Interferences in Appeal No. 2006-2136

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CORRECTED BRIEF FOR APPELLANTS

PAUL LEW AND JASON SCHIERS

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CERTIFICATE OF INTEREST

Counsel for Appellants, Dana Andrew Alden, certifies the following:

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Paul Lew and Jason Schiers

2. The name of the real party in interest represented by me is:

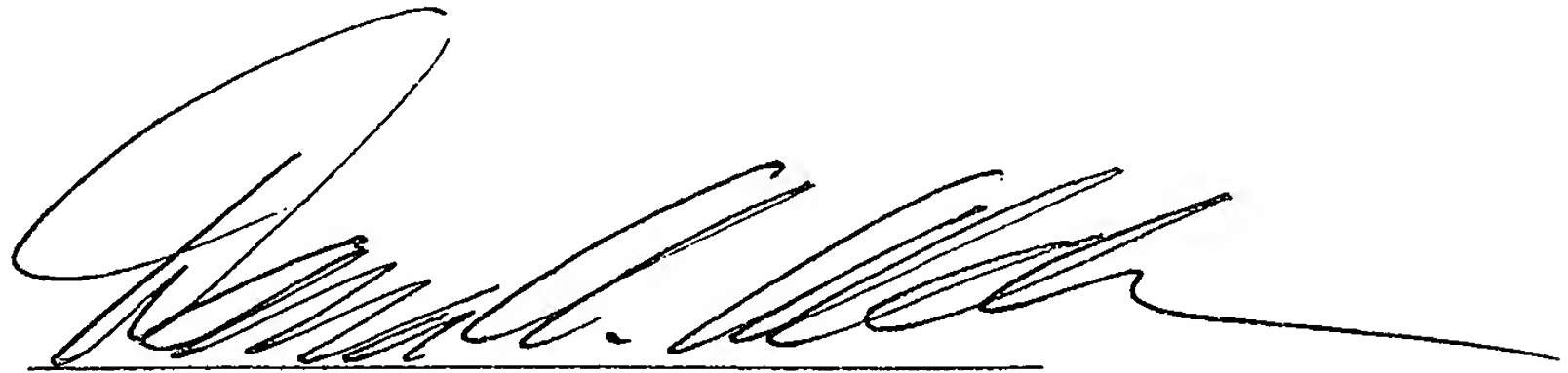
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3. All parent corporations and any publicly held companies that own 10% or more of the stock of the party represented by me are:

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4. The name of all law firms and the partners or associates that appeared for the party or amicus now represented by me before the trial court or agency, or expected to appear in this court are:

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Dana Andrew Alden  
May 8, 2007

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## **STATEMENT OF RELATED CASES**

There is no other appeal in or from this proceeding that was previously before this or any other appellate court.

## **APPELLANT JURISDICTIONAL STATEMENT**

The U.S. Patent and Trademark Office Board of Patent Appeals and Interferences (“the Board”) had subject matter jurisdiction over this proceeding pursuant to 35 U.S.C. § 134. On November 29, 2006, the Board entered its Decision on Appeal (“Decision”) affirming the Examiner’s rejection of claim 19 of U.S. Patent Application No. 10/658,143 (the ‘143 Application”). A1. On January 26, 2007, the Applicants filed a timely Notice of Appeal from the Board’s Decision in accordance with 35 U.S.C. §§ 141 and 142. The Court has jurisdiction over this appeal under 28 U.S.C. § 1295(a)(4) and 35 U.S.C. §§ 141 and 144.

## I. STATEMENT OF ISSUES

1. Whether the Board erroneously disregarded Applicants' specification and the understanding of one skilled in the art in applying the written description requirement and in defining the term "curved member."
2. Whether Applicants' amendment of the specification to recite a "curved member" violated the written description requirement, 35 U.S.C. § 112, first paragraph, when the specification inherently disclosed a "curved surface."
3. Whether the Board erred in requiring Applicants to disclose multiple species of a single word used in a claim in order to satisfy the written description requirement of 35 U.S.C. § 112, first paragraph.

## II. STATEMENT OF THE CASE

This appeal is from the decision of the Board of Patent Appeals and Interferences (the Board) in Appeal No. 2006-2136 for U.S. Patent Application No. 10/658,143 (the '143 Application). In an amendment, to the specification, Applicants replaced the terms "roller bearing," "ball bearing," and "ball surface" with the term "curved member." Applicants also tendered a new claim, Claim 19, wherein Applicants claimed "curved members." According to the Board, Applicants introduced prohibited new matter when they replaced the terms roller bearing," "ball bearing," and "ball surface" with the term "curved member" in

violation of the written description requirement of 35 U.S.C. § 112. Though the Board stated that Applicants did not comply with 35 U.S.C. § 112, first paragraph, the Board also concluded that the pending Claim 19 of the '143 Application was novel.

The issue on appeal is whether replacing the terms “roller bearing,” “ball bearing,” and “ball surface” with the term “curved member” constitutes the introduction of prohibited new matter in violation of the written description requirement of 35 U.S.C. § 112, first paragraph. Because Applicants fully complied with 35 U.S.C. § 112, this Court should reverse the Board’s Decision on Appeal.

### **III. STATEMENT OF THE FACTS**

#### **A. Background Facts**

The '143 Application is a continuation of a previous application, specifically the 09/840,778 Application filed on April 25, 2001 (the '778 Application”). In the '778 Application, Applicants’ disclosure included a description of two sleeves (referred to in this brief as “a first sleeve” and “a second sleeve”). The '778 Application depicts the first and second sleeves rotating freely relative to each other when torque is not applied. However, when torque is applied, the '778 Application depicts the first sleeve engaging the second sleeve through the use of

“curved members.”<sup>1</sup> In the ‘778 Application, Applicants described multiple ways in which to practice the disclosed invention, including, but not limited to, the multiple configurations shown in Figures 8A, 8B, 8C, 8D, as well as the use of curved members taking the form of “ball bearings,” “roller bearings,” and “ball surfaces.” A230, 232.

Presently, the ‘143 Application, entitled “Wheel Hub with Clutch,” contains a single claim (‘Claim 19’) directed to a wheel hub with a clutch, including a hub body, a first sleeve, a second sleeve, and a plurality of curved members. A2, A138. Claim 19 was drafted, along with an amendment to the specification, in response to an Office Action mailed on April 20th, 2004. The amendment submitted on August 20th, 2004, canceled claims 1-18, added new Claim 19 and amended the specification. Applicants amended the specification by replacing the terms “ball bearing,” “roller bearing” and “ball surface” with “curved member(s).” Specifically, Applicants amended the term “roller bearing” in the Brief Description of the Drawings. A175. Applicants also amended the term “ball surface” in the Summary of the Invention. A173.

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<sup>1</sup> Applicants respectfully point out that the term “curved member” was not used in the ‘778 Application. Rather, the specification of the ‘778 Application disclosed the use of “roller bearings,” “ball bearings,” and “ball surfaces.” For ease of reference, Applicants refer to all of the foregoing as simply “curved members” in recognition of the attribute that a roller bearing, a ball bearing, and a ball surface share: a curved surface.

On January 25th, 2005, the Examiner issued a final rejection of Claim 19 of the '143 Application on the basis that the replacement of "roller bearing," "ball bearing," and "ball surface" with "curved member" represented the introduction of prohibited new matter, and therefore, Claim 19 failed to comply with the written description requirement of 35 U.S.C. § 112, first paragraph. A78. The Examiner also rejected Claim 19 under 35 U.S.C. § 102 as anticipated by U.S. Patent No. 3,435,016 to Vogt (hereinafter referred to as "Vogt"). A78-80. Applicants timely filed a Notice of Appeal on January 26, 2006. On November 29, 2006, the Board of Patent Appeals and Interferences ("the Board") reversed the Examiner's rejection of Claim 19 under 35 U.S.C. § 102, but sustained the Examiner's new matter rejection under 35 U.S.C. § 112, first paragraph. A1.

**B. Subject Matter of the '143 Application**

The subject matter of the '143 Application is directed to a wheel hub that provides free-wheeling when torque is not applied but engagement when torque is applied. The specification discloses a number of sleeves including an "axle bearing sleeve 49" that includes a "ring 56" which is provided with a series of "slots 57 formed around its outer surface." A179, ll. 13-15. The specification also discloses "a center sleeve 41" that includes a "wall 62" provided with a "plurality

of steps 63.” A161-62. A plurality of “curved members 59”<sup>2</sup> are located within the “slots 57” of the “axle bearing sleeve 49.” A-162. These “curved members” move within the “slots 57” when torque is applied to engage the “center sleeve 41.” A162.

In Claim 19, Applicants claimed “a first sleeve” that includes “a plurality of slots.” Claim 19 also recites “a plurality of curved members” that travel within the slots. Applicants also claimed “a second sleeve” that includes “a plurality of steps.” Claim 19 furthermore recites how the “curved members” travel within the slots of the first sleeve to contact the steps of the second sleeve and transfer torque.

### **C. The Disclosure of the ‘778 Application**

The ‘778 Application discloses multiple configurations as shown in Figures 8A, 8B, 8C, and 8D, as well as the use of “ball bearings,” “roller bearings,” and “ball surfaces.” In one embodiment, shown in Figures 6A, 6B, and 6C, the ‘778 Application discloses a “roller bearing.” A232. In Figure 6B, the ‘778 Application teaches the movement of “roller bearings” within the slots. A232, A254. In Figure 6C, the ‘778 Application illustrates the “roller bearings as having fully moved into binding engagement” between the two sleeves. A232, A255.

The ‘778 Application, as filed, further describes another embodiment wherein torque is transferred through the use of “a multitude of ball bearings”

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<sup>2</sup> Applicants point out that whether the ‘143 Application disclosed a “curved member” is disputed between the parties.



located within a plurality of slots. A228. The '778 Application also refers to how a "ball surface" could be employed without repeated scuffing when torque is transferred between the two sleeves. A230.

#### **D. The Board's Decision**

On November 29, 2006 (A1), the Board reversed the Examiner's rejection of Claim 19 under 35 U.S.C. § 102 as being anticipated by Vogt but sustained the Examiner's rejection under 35 U.S.C. § 112, first paragraph.

Largely confining its analysis to the dictionary, the Board reviewed the meanings of the terms "ball bearing" and "curve" and, based on the dictionary, concluded that Applicants had impermissibly included new matter in the '143 Application. According to the Board, Webster's dictionary defines "ball bearing" as: "a bearing in which the moving parts revolve or slide on freely rotating metal balls so that friction is reduced." A7. The Board then observed that Webster's dictionary defines "curve" as: "a line having no straight part." A7. Based on the foregoing dictionary definitions, the Board defined the term "curved member" as including "a basketball, an M&M candy and the curved surface of a computer mouse." A8.

After defining the term "curved members" to include "basketballs," "M&M candies," and "the surface of a computer mouse," not surprisingly, the Board did not find disclosure of candy, sporting goods, or computer equipment of any kind,

and therefore, concluded that the originally filed disclosure failed to support anything other than a ball bearing. A8.

Though the Board concluded that the specification of the '143 Application failed to support the claim term "curved member," the Board recognized that a "curved surface" was inherently disclosed and that a ball bearing was a type of curved member. A9.

#### **IV. SUMMARY OF THE ARGUMENT**

In upholding the Examiner's 35 U.S.C. § 112, first paragraph, written description rejection, the Board unreasonably defined the term "curved member" to include basketballs, M&M candies, and the curved surface of a computer mouse. The Board erred in construing Applicants' specification as disclosing only a single-embodiment utilizing a "ball bearing," when clearly the '143 Application disclosed more, such as the use of a "roller bearing" and the use of a "ball surface." Furthermore, the Board misapplied this Court's precedent and misconstrued the requirements of 35 U.S.C. § 112, first paragraph. For these reasons, the Board erred in concluding that replacement of "roller bearing," "ball bearing," and "ball surface" with the term "curved member" introduced prohibited new matter into the specification, thereby causing Claim 19 to fail the written description requirement of 35 U.S.C. § 112, first paragraph. Accordingly, this Court should reverse the decision of the Board.

## V. ARGUMENT

### A. Standard of Review

The Board's decision that replacement of "roller bearing," "ball bearing," and "ball surface" with "curved member" represented the introduction of prohibited new matter, thereby causing Claim 19 to fail the written description requirement of 35 U.S.C. § 112, first paragraph is a factual finding and is reviewed for substantial evidence. See Vas-Cath Inc. v. Mahurhar, 935 F.2d 1555, 1158 (Fed. Cir. 1991). This Court reviews the Board's findings of fact for substantial evidence in the administrative record. See In re Gartside, 203 F.3d 1305, 1313 (Fed. Cir. 2000) (adopting substantial evidence standard for review of Board fact-findings).

### B. **The Board Erroneously Disregarded Applicants' Specification and the Understanding of One Skilled In the Art in Applying the Written Description Requirement and in Defining the term "curved member."**

Without any reference to Applicants' specification or to the understanding of one skilled in the art, the Board unreasonably defined "curved member" to include "a basketball, an M&M candy and the curved surface of a computer mouse." A8. In construing claim terms, the Board must consider the specification and the understanding of one of ordinary skill in the art. In re Morris, 127 F.3d 1048, 1054 (Fed. Cir. 1997) (noting that "it would be unreasonable for the PTO to ignore any interpretive guidance afforded by the applicant's written description). To the

extent that the Board was applying the written description requirement (as opposed to construing the claim), this Court has stated that “[t]he written description requirement must be applied in the context of the particular invention and the state of the knowledge.” Capon v. Eshhar, 418 F.3d 1349, 1358 (Fed. Cir. 2005).

In this case, the term “curved member” occurs in the context of a hub with a clutch. Plainly, one of ordinary skill in the art would understand that Applicants were not referring to candy, sporting goods, or computer equipment. Insisting that random objects with a “curve” were within the scope of the claim term “curved member,” the Board ignored Applicants’ written description which would clearly convey to one of ordinary skill in the art the unsuitability of computer equipment, chocolate candy, and leather balls (assuming the Board was referring to NBA regulation basketballs) in a hub and clutch mechanical device.

Resort to the dictionary further illustrates the Board’s error. The dictionary itself defines a “roller bearing” as “a bearing in which the journal rotates in peripheral contact with a number of rollers usu. contained in a cage.” See Merriam-Webster’s Collegiate Dictionary at 1012 (10<sup>th</sup> Edition 2002). In the dictionary, a roller bearing is not a spherically-shaped “ball bearing.” Rather, in the dictionary, a “roller bearing” appears more cylindrically shaped than spherically-shaped. Hence, Applicants’ claim term “curved member” is broad enough to include both a spherically-shaped ball bearing and the differently shaped

roller bearing, while, at the same time, sufficiently narrow to exclude curved candy, basketballs, and the curved surface of computer mice. While adopting an unreasonably broad definition of the term “curved member,”<sup>3</sup> the Board adopted an erroneously narrow understanding of Applicant’s disclosure. The Board simply failed to recognize that Applicants had disclosed more than a “ball bearing.”

That “curved member” is broader than a ball bearing does not introduce new matter into the specification; as this Court has warned, “[b]roadening a claim does not add new matter to the disclosure.” In re Rasmussen, 650 F.2d 1212, 1214 (CCPA 1981). This error alone justifies reversal of the Board’s decision.

**C. Because The Specification Inherently Disclosed a “curved surface,” Applicants did not Violate the Written Description Requirement, 35 U.S.C. § 112, First Paragraph, in Amending the Specification to Recite a “curved member.”**

Applicants fully complied with the written description requirement of 35 U.S.C. § 112, first paragraph, in simply amending the specification to recite the inherently disclosed “curved surface.” According to this Court, the “description of the invention” requirement of 35 U.S.C. § 112, first paragraph is “relatively simple to comply with.” In re Angstadt, 537 F.2d 498, 502 (CCPA 1976). An Applicant need not recite claim terms within the specification “in haec verba” in order to comply with the written description requirement of 35 U.S.C. § 112, first

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<sup>3</sup> Applicants respectfully submit that any construction of “curved member” that includes “M&M candies” within its scope is unreasonable.

paragraph. Kao Corp. v. Unilever U.S., Inc., 441 F.3d 963, 968 (Fed. Cir. 2006).

The written description requirement “insures that subject matter presented in the form of a claim subsequent to the filing date of the application was sufficiently disclosed at the time of filing so that the prima facie date of invention can fairly be held to be the filing date of the application.” Vas-Cath Inc. v. Mahurkar, 935 F.2d 1555, 1562 (Fed. Cir. 1991). For this reason, the written description requirement is used to “police the addition of new matter to the claims.” See, e.g., Moba v. Diamond Automation, Inc., 325 F.3d 1306, 1319 (Fed. Cir. 2003). Consequently, all that an Applicant must do under the written description requirement of 35 U.S.C. § 112, first paragraph, is disclose the invention so that one of ordinary skill in the art would recognize that the applicants invented what is now claimed. All Dental Prodx, LLC v. Advantage Dental Products Inc., 309 F.3d 774, 779 (Fed. Cir. 2002). Though the Board recognized that Applicants’ original disclosure inherently disclosed a “curved surface” (See A8-A9), the Board erred in concluding that Applicants had introduced prohibited new matter that rendered Claim 19 fatally flawed under the written description requirement of 35 U.S.C. § 112, first paragraph.

There is little question regarding Applicants’ right to priority in this case. It has long been recognized that an application may be amended to recite a function, theory, or advantage inherent to a device disclosed in the originally filed patent



application without introducing prohibited new matter. In re Reynolds, 443 F.2d 384, 389 (CCPA 1971); see also Schering Corp. v. Amgen Inc., 222 F.3d 1347, 1352 (Fed. Cir. 2000) (“The fundamental inquiry is whether the material added by amendment was inherently contained in the original application.”). The Board in this case already recognized that Applicants had inherently disclosed a “curved member.” See A8-A9 (recognizing that curved surfaces had inherently been disclosed). Having inherently disclosed “curved surfaces,” Applicants did not introduce prohibited new matter in replacing “roller bearing,” “ball bearing,” and “ball surface” with the term “curved member.” Claim 19, therefore, should not have been rejected as claiming new matter in violation of the written description requirement of 35 U.S.C. § 112, first paragraph, as the Examiner held in this case. Accordingly, the Board’s decision to sustain the Examiner’s new matter rejection should be reversed.

**D. The Board Misconstrued the Written Description Requirement, 35 U.S.C. § 112, First Paragraph, as Requiring Applicants to Disclose Multiple Species of a Single Word Used in a Claim.**

Neither the Board nor the Examiner found Claim 19 to be a generic claim, requiring the disclosure of multiple species for support under the written description requirement of 35 U.S.C. § 112, first paragraph. Rather, the Board concluded that Applicants’ isolated use of the word “curved member” in Claim 19 required multiple species for support. However, Applicants are under no

obligation to disclose multiple species of a single word used in a claim in order to satisfy the written description requirement of 35 U.S.C. § 112, first paragraph.

Construing Section 112, first paragraph, as imposing a written description requirement for each and every word appearing in a claim, as opposed to the claimed invention as a whole, the Board committed clear legal error. Plainly, Section 112 requires a written description of “the invention,” not each and every word used in claiming the invention.

As this court has stated on numerous occasions, “it is the claims that measure the invention,” (see, e.g., Rexnord Corp. v Laitram Corp., 274 F.3d 1336, 1344 (Fed. Cir. 2001)), and therefore, the written description requirement of 35 U.S.C. § 112, first paragraph should have been applied to Claim 19 as a whole, rather than to an individual word appearing in Claim 19, as the Board did in this case. A brief example illustrates the point; in Cordis Corp. v. Medtronic AVE, Inc., 339 F.3d 1352, 1355 (Fed. Cir. 2003), the applicant claimed a “tubular member.” Employing the Board’s reasoning, the patent in Cordis should have been held invalid because a “tubular member” includes a straw from McDonald’s, a septic pipe, or the tubular structure of the Space Shuttle’s booster rocket.<sup>4</sup> Yet,

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<sup>4</sup> Applicants observe that the term “member” is quite commonly used in claims. Indeed, over half a million patents use the term, and Applicants do not believe that all of these patents could be invalid because of the potential breadth of the term alone.



neither a McDonald's straw, nor a septic pipe, nor a booster rocket could be used in the stent claimed in Cordis.

Nonetheless, this Court did not construe the written description requirement of 35 U.S.C. § 112, first paragraph, to require that multiple species of "tubular members" be disclosed. See Cordis Corp. 339 F.3d at 1664-65 (holding that a claim using the term "tubular member" did not violate the written description requirement of 35 U.S.C. § 112, first paragraph). To the contrary, this Court held that "[a] specification may, within the meaning of 35 U.S.C. § 112, para. 1, contain a written description of a broadly claimed invention without describing all species the claim encompasses." Cordis Corp., 339 F.3d at 1365.

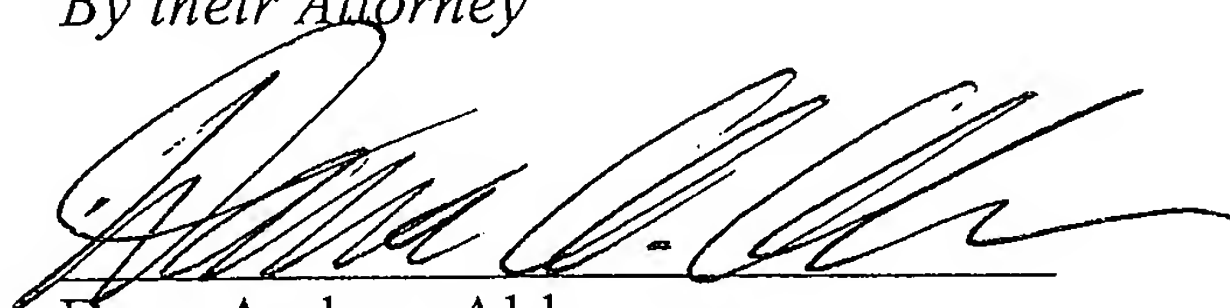
Even assuming *arguendo* that Applicants failed to disclose multiple species of "curved members" (such as a "roller bearing," "ball bearing," as well as the use of a "ball surface"), any such failure did not violate the written description requirement of 35 U.S.C. § 112, first paragraph. Given that Claim 19 is not a generic claim (and neither the Board nor the Examiner in this case found otherwise), Applicants were not required to disclose multiple species of a single word appearing in the claim. The Board simply erred in construing the written description requirement of 35 U.S.C. § 112, first paragraph. Accordingly, the decision of the Board should be reversed and Claim 19 allowed to issue.

## VI. CONCLUSION

For the foregoing reasons, this Court should reverse the Board's rejection of Claim 19 of the '143 Application under 35 U.S.C. § 112, first paragraph.

Appellants,  
Paul Lew and Jason Schiers

*By their Attorney*

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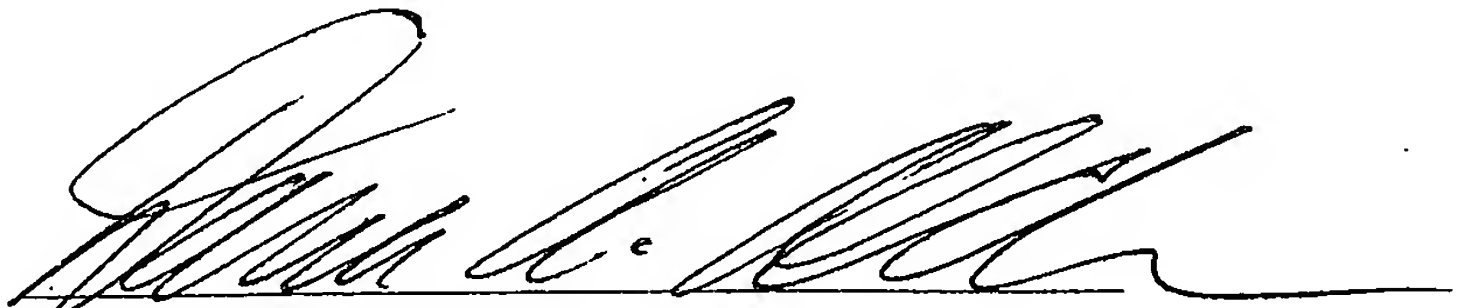
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## CERTIFICATE OF SERVICE

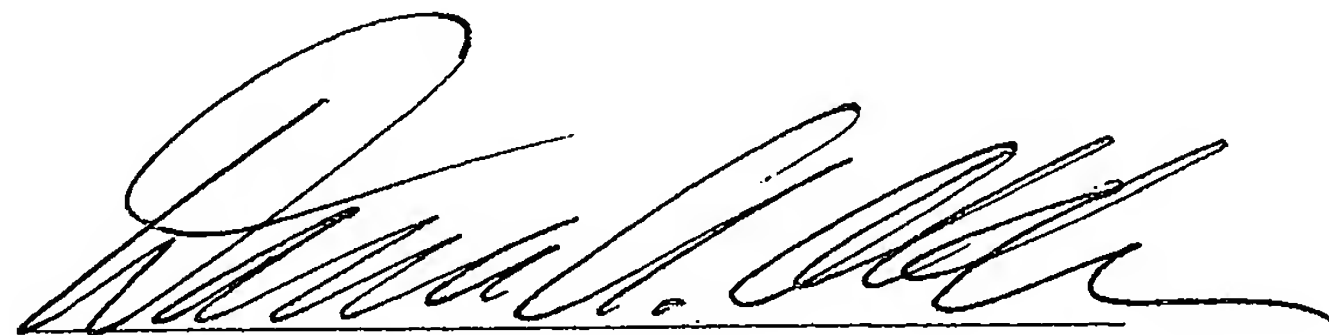
I, Dana Andrew Alden, certify that an original and eleven (11) copies of the foregoing Corrected Brief for Appellants, Paul Lew and Jason Schiers, were filed on this date, via first class mail, addressed to: Clerk of Court, United States Court of Appeals for the Federal Circuit, 717 Madison Place, N.W., Washington, D.C. 20439.

I, Dana Andrew Alden, certify that two true and correct copies of the foregoing Corrected Brief for Appellants, Paul Lew and Jason Schiers, were served on this date, via first class mail, addressed to: Mr. Benjamin D. M. Wood, Office of the Solicitor, P.O. Box 15667, Arlington, Virginia 22215.

  
Dana Andrew Alden  
May 8, 2007

### **CERTIFICATE OF COMPLIANCE WITH RULE 32(a)**

I, Dana Andrew Alden, certify that the foregoing brief complies with the type-volume limitation set forth in Fed. R. App. P. 32(a)(7)(B). Specifically, this brief contains 3,618 words, excluding the parts of the brief exempted by Fed. R. App. P. 32(a)(7)(B)(iii), as determined by the word count feature of the word processing program used to create this brief. I further certify that the foregoing brief complies with the typeface requirements set forth in Fed. R. App. P. 32(a)(5) and the type style requirements of Fed. R. App. P. 32(a)(6). Specifically, this brief has been prepared using a proportionately spaced typeface using Microsoft Office Word 2003, in 14-point Times New Roman font.

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Dana Andrew Alden

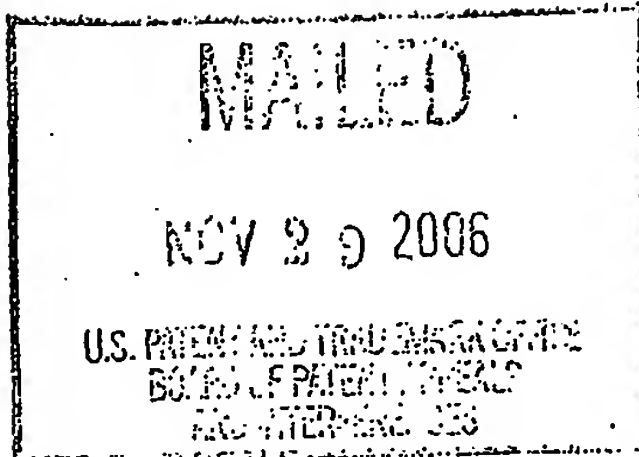
## ADDENDUM

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

Ex parte PAUL LEW and JASON SCHIERS



Appeal No. 2006-2136  
Application No. 10/658,143  
Technology Center 3600

ON BRIEF

Before FRANKFORT, LEVY, and FETTING, Administrative Patent Judges.  
LEVY, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claim 19<sup>1</sup>, which is the sole claim pending in this application.

We AFFIRM.

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<sup>1</sup> The Supplemental amendment filed November 8, 2004, which included claims 20-39, was denied entry by the examiner (answer, page 4), leaving only claim 19 before us for decision on appeal. We are not persuaded by appellants' assertion (brief, page 2) that "Applicants appeal the examiner's refusal to enter Applicants' Supplemental Amendment." As correctly noted by the examiner (answer, page 2) non-entry of an amendment is a petitionable matter under 37 CFR § 1.181 and is not subject to appeal. Accordingly, claims 20-39 are not properly before us for decision on appeal.

BACKGROUND

The appellants' invention relates to a wheel hub with a clutch (specification, page 1).

19. A hub with clutch comprising:

- a) a hub body including a first sleeve and a second sleeve;
- b) the first sleeve includes an outer surface that includes a plurality of slots, wherein said slots are provided with a forward section, a tapered section, and an outwardly sloping surface extending from the forward section to the tapered section;
- c) the second sleeve includes a wall that includes a plurality of steps; and
- d) a plurality of curved members, wherein said curved members travel from the forward section along the outwardly sloping surface toward the tapered section, whereat the curved members contact the steps and transfer torque between the first sleeve and the second sleeve.

The prior art reference of record relied upon by the examiner in rejecting the appealed claims is:

Vogt

3,432,016

Mar. 11, 1969

Appeal No. 2006-2136  
Application No. 10/658,143

Claim 19 stands rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement<sup>2</sup>.

Claim 19 stands rejected under 35 U.S.C. § 102(e) as being anticipated by Vogt.

In addition, the examiner has objected to and denied entry of the substitute specification, where appellants have replaced "ball bearing(s)" with "curved member(s)".<sup>3</sup>

Rather than reiterate the conflicting viewpoints advanced by the examiner and the appellants regarding the above-noted rejections, we make reference to the answer (mailed February 13, 2006) for the examiner's complete reasoning in support of the rejections, and to the brief (filed January 19, 2006) and reply brief (filed April 13, 2006) for the appellants' arguments thereagainst.

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<sup>2</sup> The rejection of claim 19 under 35 U.S.C. § 112, second paragraph, has been withdrawn by the examiner (answer, page 4).

<sup>3</sup> Although we do not usually review objections, as correctly noted by the examiner (answer, page 4), MPEP § 2163.06II states that "[i]f both the claims and specification contain new matter either directly or indirectly, and there has been both a rejection and an objection by the examiner, the issue becomes appealable and should not be decided by petition. Accordingly, in addition to considering the rejection of claim 19 under 35 U.S.C. § 112, first paragraph, we will also consider the examiner's objection to the substitute specification.



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Only those arguments actually made by appellants have been considered in this decision. Arguments which appellants could have made but chose not to make in the brief have not been considered. See 37 CFR § 41.37(c)(1)(vii)(eff. Sept. 13, 2004).

#### OPINION

In reaching our decision in this appeal, we have carefully considered the subject matter on appeal, the rejections advanced by the examiner, and the evidence of lack of written description and anticipation relied upon by the examiner as support for the rejections. We have, likewise, reviewed and taken into consideration, in reaching our decision, appellants' arguments set forth in the briefs along with the examiner's rationale in support of the rejections and arguments in rebuttal set forth in the examiner's answer.

Upon consideration of the record before us, we make the determinations which follow. We begin with the objection to the substitute specification and the rejection of claim 19 under 35 U.S.C. § 112, first paragraph as lacking written description. The examiner's position (answer, page 6) is that since the substitute specification only sets forth curved members, applicant is broadening the disclosure to include other members,

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which he did not show possession of at the time of filing. The examiner argues (answer, page 7) that "Applicant originally disclosed only 'ball bearings' throughout the entirety of [sic, the] original disclosure." The examiner asserts (id.) that on August 23, 2004, appellants filed an amendment that included a substitute specification, in which applicant replaced the ball bearings with curved members throughout the entirety of the original specification, and added new claim 19, in which applicant also introduced the phrase "curved member." The examiner maintains (id.) that "the newly introduced material 'curved member', in place of the originally disclosed 'ball bearing(s)', as presented in the substitute specification, has broadened the specification to include other types of bearings such as the tapered bearing, the cylindrical bearing, the sleeve bearing, and the roller bearing."

Appellants assert (brief, page 4) that "the substitute specification of August 23, 2004 simply made more explicit what was already inherently disclosed, and therefore, the substitute specification of August 23, 2004 did not introduce new matter into the specification. See M.P.E.P. § 2163.07(a)." It is argued (brief, page 6) that "the properties of the originally disclosed 'ball bearing' include having a curved outer surface."

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Consequently, Applicants' amendment, wherein 'ball bearing' was changed to 'curved member,' does not represent the introduction of prohibited new matter." In the reply brief, appellants argue (page 3) that there is nothing improper with amending the application to recite or claim an inherent function, theory, property or advantage, citing MPEP § 2163.07(a). It is argued (*id.*) that the examiner has confused the concept of breadth with the prohibition against introducing new matter or claiming subject matter in violation of the written description requirement.

To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention. See, e.g., Moba, B.V. v. Diamond Automation, Inc., 325 F.3d 1306, 1319, 66 USPQ2d 1429, 1438 (Fed. Cir. 2003). The issue raised is most often phrased as whether the original application provides adequate support for the claims at issue or whether the material added to the specification incorporates "new matter" in violation of 35 U.S.C. § 132<sup>4</sup>. An applicant shows possession of the claimed invention by describing the claimed invention with all

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<sup>4</sup> MPEP § 2163.

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of its limitations. Most typically, the issue will arise in the context of determining whether new or amended claims are supported by the description of the invention in the application as filed. The proscription against introduction of new matter in a patent application serves to prevent an applicant from adding information that goes beyond the subject matter originally filed<sup>5</sup>. A ball bearing is defined as "a bearing in which the moving parts revolve or slide on freely rotating metal balls so that friction is reduced."<sup>6</sup> From the definition of a ball bearing, and the ball bearings disclosed in appellants originally filed specification, as illustrated in appellants originally filed drawings, we find that the ball bearings include a metal ball. A curve is "a line having no straight part."<sup>7</sup> From the definition of a curve as a line having no straight part, we find that the phrase "curved member" is much broader and far more encompassing than a "ball bearing," and that a "ball bearing" is a small subset of "curved members." We further find that not all curved members can carry out the claimed operation of the claimed

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<sup>5</sup> id.

<sup>6</sup> Webster's New World Dictionary, © 1972. A copy of the pertinent page is attached to this Decision.

<sup>7</sup> Webster's New World Dictionary, © 1972. A copy of the pertinent page is attached to this Decision.

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curved members? For example, a basketball, an M&M candy and the curved surface of a computer mouse can all be considered to be curved members, but are not capable of functioning as the curved members of appellants' claims.

From our review of the originally filed disclosure, we find that element(s) 59 are consistently referred to as "ball bearings." We find nothing in the originally filed disclosure that would have indicated to an artisan that anything other than a ball bearing could be used for this disclosed element. We additionally note that the specification also refers to the prior art as using ball bearings (pages 2 and 3). In the arguments provided, appellants have not pointed to any portion of the original disclosure that would have indicated to an artisan that element(s) 59 could be anything other than "ball bearings." Rather, appellants assert (brief, page 4) that "curved member" is inherent from the disclosure of "ball bearing."

While there is no *in haec verba* requirement, newly added claim limitations must be supported in the specification through express, implicit or inherent disclosure. To be inherent, the missing descriptive matter is necessarily present in the thing described, and would be so recognized by persons of ordinary skill. Appellants are correct (brief, page 6) that a ball

bearing has a curved surface. However, there is no convincing evidence in the record that the limited disclosure in the specification of a ball bearing, without any indication that anything else could be used, would reasonably convey to an artisan that appellants had possession of the broader concept of any "curved member." That is, persons of ordinary skill in the art would not recognize in the disclosure a description of "curved members" as recited in claim 19 from the disclosure of "ball bearings."

Rather, we find that the "ball bearing" is a species of the larger, more encompassing genus of "curved member." The written description requirement for a claimed genus may be satisfied through sufficient description of a representative number of species. There may be situations where one species adequately supports a genus. "The disclosure of only one species encompassed within a genus adequately describes a claim directed to that genus only if the disclosure "indicates that the patentee has invented species sufficient to constitute the gen[us]." See Enzo Biochem, 323 F.3d 956, 966, 63 USPQ2d 1609, 1615 (Fed. Cir. 2002).<sup>8</sup>" In this instance, because we do not find from the originally filed disclosure any suggestion or teaching that

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<sup>8</sup> MPEP § 2163.05.

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anything other than a ball bearing can be used, and appellants have not pointed to any portion of the specification indicating or suggesting that the ball bearing(s) could be replaced with other structures, we are not convinced of any error on the part of the examiner in denying entry of the substitute specification or in rejecting claim 19 under 35 U.S.C. § 112, first paragraph. As stated, supra, ball bearing(s) are a small subset of curved member(s), and that not all curved members will function in place of the originally disclosed and claimed ball bearing(s). From all of the above, we find that appellants have impermissibly added new matter into the specification and claims. We hold that the examiner was correct in denying entry of the substitute specification. The rejection of claim 19 under 35 U.S.C. § 112, first paragraph is sustained.

We turn next to the rejection of claim 19 under 35 U.S.C. § 102(b) as being anticipated by Vogt. The examiner asserts, inter alia, that the first sleeve is met by element 1 of Vogt and that the second sleeve is met by the interior portion of element 8. Appellants assert (brief, page 8) that Vogt is directed to non-analogous art since the reference relates to a free wheel coupling device for timepieces. We are unpersuaded by

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appellants' argument regarding non-analogous art because the rejection is under 35 U.S.C. § 102.

Appellants further argue that claim 19 recites a hub body and that Vogt does not teach a hub body. From our review of the disclosure we find no specific definition of a hub body. Turning to a dictionary definition, we find that a hub is defined as "the center part of a wheel, etc., the part fastened to the axle, or turning on it."<sup>9</sup> From the definition of a hub, we agree with the examiner (answer, page 8) that the body 1 (figure 3) constitutes a hub since the body is fastened to axle 2 and turns on the axle.

Appellants additionally assert (reply brief, page 2) that Vogt does not support the examiner's finding of first and second sleeves. We agree. The specification does not provide a definition of a sleeve. Turning to a dictionary definition, we find that a sleeve is defined as "a tube or tubelike part fitting around or over or around another part."<sup>10</sup> From the definition of the term tube, we find that the flat, radially extending plates 1 and the inside of 8 of Vogt do not meet the claimed sleeves.

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<sup>9</sup> Webster's New World Dictionary © 1972. A copy of the pertinent page is attached to this Decision.

<sup>10</sup> Webster's New World Dictionary, © 1972. A copy of the pertinent page is attached to the Decision.



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Thus, although Vogt discloses the claimed clutch mechanism, Vogt does not anticipate claim 19 because Vogt does not teach the claimed first and second sleeves. Accordingly, we cannot sustain the rejection of claim 19 under 35 U.S.C. § 102 as being anticipated by Vogt.

#### CONCLUSION


To summarize, the decision of the examiner to reject claim 19 under 35 U.S.C. § 112, first paragraph is affirmed. The decision of the examiner to reject claim 19 under 35 U.S.C. § 102(b) is reversed.

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No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR. § 1.136(a)(1)(iv).

AFFIRMED

CHARLES E. FRANKFORT  
Administrative Patent Judge

  
STUART S. LEVY  
Administrative Patent Judge

*Anton W. Fetting*  
ANTON W. FETTING  
Administrative Patent Judge

) BOARD OF PATENT  
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hindrance, disappointment, etc. 5. a blunder; error. 6. *Baseball* an illegal motion by the pitcher, such as an uncompleted motion to throw to a base, while one foot is on the rubber; it entitles each base runner to advance one base. 7. *Billiards* any of the outer spaces between the cushions and the balklines in billiards. —*vt.* 1. to miss or let slip by 2. to obstruct or thwart; foil 3. [Obs.] to make balks in (land) —*vi.* 1. to stop and obstinately refuse to move or act 2. to hesitate or recoil (of) 3. to make a balk, as in baseball —*SYN.* see FRUSTRATE —*balk'er n.*

**Bal-kan** (bôl'kân) *adj.* 1. of the Balkans, their people, etc. 2. of the Balkan Mountains

**Bal-kan-ize** (bôl'kân-iz') *vt., vi.* -ized', -iz'ing (sometimes *b-*) to break up into small, mutually hostile political units, as the Balkans after World War I —*Bal'kan-i-za'tion n.* Balkan Mountains mountain range extending across C. Bulgaria, from the Yugoslav border to the Black Sea; highest peak, c. 7,800 ft.

**Balkan Peninsula** peninsula in SE Europe, between the Adriatic & the Black seas

**Bal-kans** (bôl'kânz) countries of the Balkan Peninsula (Yugoslavia, Bulgaria, Albania, Greece, & the European part of Turkey) & Romania; also Balkan States

**Balkh** (bâlkh) town in N Afghanistan; in ancient times it was the capital of Bactria

**Bal-khash** (bâl'khash') Lake large salt lake in the SE Kazak S.S.R.; c. 6,700 sq. mi.

**balk-line** (bôk'lin') *n.* *Billiards* 1. a line at one end of a table, from behind which a player must cue off or resume playing when his ball has left the table 2. any of four lines drawn on a table, parallel to the sides and ends so as to form eight outer spaces; in balkline billiards, a player may not make more than one or two caroms in any space on the cushion side of a balkline without driving a ball out of that space

**balk-y** (bôk'yē) *adj.* balk'y-er, balk'y-est in the habit of balking; stubbornly resisting —*SYN.* see CONTRARY

**ball** (bôl) *n.* [ME. *bal* < OE. *\*bailu* < IE. base *\*bhel-*, to swell, whence *BOWL*, *BLADDER*, ON. *bollr*, OHG. *ballo*, Gr. *phallos*, L. *foliis* & *flare*] 1. any round, or spherical, object; sphere; globe 2. a planet or star, esp. the earth 3. a) a round or egg-shaped object used in various games b) any of several such games, esp. baseball 4. a throw or pitch of a ball; esp., the style of delivery of a baseball or other ball (a fast ball) 5. a) a solid missile or projectile for a cannon or firearm b) such projectiles for firearms, collectively 6. a) a rounded part of the body (the ball of the foot) b) [Slang] the testicles: a vulgar usage 7. *Baseball* a pitch that is wide of the plate or goes above the shoulder or below the knee of the batter and is not struck at by him 8. *Horticulture* the roots of a plant, bound and packed for shipping —*vi.* 1. to form into a ball —*ball up* [see *BOLLIX*] 2. [Slang] to muddle or confuse —*to be on the ball* [Slang] to be alert; be efficient —*to carry the ball* [Colloq.] to assume responsibility; take command —*to get (or keep) the ball rolling* [Colloq.] to start (or maintain) some action —*to have something on the ball* [Slang] to have ability —*play ball* 1. to begin or resume playing a ball game 2. to begin or resume any activity 3. [Colloq.] to cooperate

**ball** (bôl) *n.* [Fr. *bal* < OFr. *baller*, to dance < LL. *ballare* < Gr. *ballein*, to throw (with sense of *ballizein*; to dance, jump about)] 1. a formal social dance 2. [Slang] an enjoyable time or experience

**Ball** (bôl), John ?-1381; Eng. priest; executed as an instigator of the peasants' revolt led by Wat Tyler

**bal-lad** (bal'ad) *n.* [ME. *balad* < OFr. *ballade*, dancing song < OProv. *ballada*, (poem for a) dance < *balor*, to dance < LL. *ballare*; see *BALL*] 1. a romantic or sentimental song with the same melody for each stanza 2. a song or poem that tells a story in short stanzas and simple words, with repetition, refrain, etc.: most old ballads are of unknown authorship and have been handed down orally in more than one version 3. a slow, sentimental popular song, esp. a love song

**bal-lade** (bâ lād', ba-) *n.* [Fr.: see prec.] 1. a verse form that has three stanzas of eight or ten lines each and an envoy of four or five lines: the last line of each stanza and of the envoy is the same 2. a musical composition of a romantic or narrative nature, esp. for piano

**bal-lad-der** (bal'ad dîr') *n.* a ballad singer

**bal-lad-mon-ger** (bal'ad mun'gîr, -mân') *n.* 1. a seller of popular ballads, esp. one who hawked them in the streets 2. an inferior poet; poetaster



BALKAN PENINSULA

**bal-lad-ry** (bal'ad rî) *n.* 1. ballads in general 2. the art of composing ballads

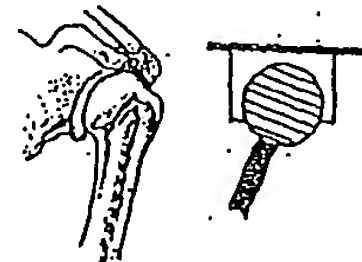
**ballad stanza** the four-line stanza commonly used in ballads, generally rhymed *abcb*

**ball and chain** 1. a heavy metal ball fastened by a chain to a prisoner's body to keep him from escaping 2. [Slang] one's wife

**ball-and-sock-et joint** (bôl'an sôk'it) a joint, as that of the hip or shoulder, formed by a ball in a socket, allowing limited movement in any direction

**Bal-la-rat** (bal'at) city in SC Victoria, Australia: pop., with suburbs, 58,000

**bal-last** (bal'ast) *n.* [LowG. < ODan. *barlast* < *bar*, bare, waste + *last*, a load] 1. anything heavy carried in a ship, aircraft, or vehicle to give stability or in a balloon or airship to help control altitude 2. anything giving stability and firmness to character, human relations, etc. 3. crushed rock or gravel, as that placed between and below the ties of a railroad —*vi.* 1. to furnish with ballast; stabilize 2. to fill in (a railroad bed, etc.) with ballast



BALL-AND-SOCKET JOINTS

**ball bearing** 1. a bearing in which the moving parts revolve or slide on freely rolling metal balls so that friction is reduced 2. any of such metal balls

**ball cock** a device consisting of a valve connected by a lever with a floating ball which shuts the valve when raised and opens it when lowered, as in flush toilets

**bal-le-ri-na** (bal'at rî'nâ) *n.* [It. < *ballare*; see *BALL*] a woman ballet dancer

**bal-let** (bal'at, ba lât') *n.* [Fr. *ballette* < It. *balletto*, dim. < *ballo*, a dance; see *BALL*] 1. a) an intricate group dance using pantomime and conventionalized movements to tell a story, usually with costumes and scenery b) the music for such a dance 2. dancing of this kind 3. a company of dancers of ballet —*bal-let-ic* (ba let'ik) *adj.*

**bal-let-o-mane** (ba let'at mân') *n.* [Fr. < It. *balletto* (see prec.) + Fr. *manie*, mania] a person enthusiastic about the ballet —*bal'let-o-ma-ni-a* (-mân'at) *n.*

**ball-flow-er** (bôl'flou'ar) *n.* *Archil.* a decoration in a molding that looks like a ball held in the petals of a flower

**bal-lis-ta** (bâ lis'ta) *n., pl.* -tae (-tê) [L. < Gr. *ballista*, to throw] a device, resembling a large mounted crossbow, used in ancient warfare to hurl heavy stones and similar missiles

**bal-lis-tic** (bâ lis'tik) *adj.* 1. of or connected with ballistics 2. of the motion and force of projectiles

**ballistic missile** a long-range missile that is guided by preset mechanisms in the first part of its flight, but is a free-falling object as it approaches its target

**bal-lis-tics** (bâ lis'tiks) *n.pl.* (with sing. *v.*) 1. the science dealing with the motion and impact of projectiles, such as bullets, rockets, bombs, etc. 2. the study of the effects of firing on a firearm or bullet, cartridge, etc. —*bal-lis-ti-cian* (bal'at tish'ân) *n.*

**ball lightning** lightning in the form of a short-lived, reddish, glowing ball, up to about a foot in diameter, infrequently reported floating in the air or moving rapidly along the ground before disintegrating

**bal-lo-net** (bal'at net') *n.* [Fr. *ballonnet*, dim. of *ballon*, BALLOON] any of several auxiliary gas containers within a balloon or airship, which can be inflated or deflated during flight to control altitude

**bal-loon** (ba lûn') *n.* [Fr. *ballon*, altered (after *ballo*, ball) < It. *ballone*, large ball < *palla*, ball < Lombard *\*palla* (OHG. *balla*), *BALL*] 1. a large, airtight bag that rises and floats above the earth when filled with hot air or a gas lighter than air, such as hydrogen or helium 2. a bag of this sort with an attached car or gondola for carrying passengers or instruments 3. a small, inflatable rubber bag, used as a toy 4. the outline enclosing the words said by a character in a cartoon, as in comic strips —*vi.* to cause to swell like a balloon; inflate —*vi.* 1. to ascend or ride in a balloon 2. to swell; expand —*adj.* like a balloon; large, round, and soft —*bal-loon'ist n.*

**balloon sail** a large, light sail used on yachts together with or instead of the customary working sails

**balloon tire** a wide, deep-walled pneumatic tire holding a large volume of air at low pressure to lessen the shock of bumps

**balloon vine** a tropical American vine (*Cardiospermum halicacabum*) bearing inflated triangular pods with large, black seeds

**bal-lot** (bal'at) *n.* [It. *ballotta*, *ballotta*, dim. of *palla*; see *BALLOON*] 1. orig. a ball, now a ticket, paper, etc., by which a vote is registered 2. act or method of voting, esp. secret voting by the use of ballots or voting machines 3. the right to vote 4. the total number of votes cast in an election 5. a list of people running for office; ticket —*vi.* [It. *ballottare*] to decide by means of the ballot; vote —*bal'lot'er n.*

**bal-lotte-ment** (bâ lât'ment) *n.* [Fr. < *balloter*, to toss <

fat, âpe, câr; ten, êven; fs, bite; gô, hôrn, tôol, look; oil, out; up, (ur; get; joy; yet; chin; she; chin, then; zh, leisure; n, ring; for a in ago, e in agent, i in sanity, o in comply, u in focus; ' as in able (â'b'l); Fr. bâl; â, Fr. cœur; ô, Fr. feu; Fr. mon; ô, Fr. coq; ô, Fr. duc; r, Fr. cri; H, G. ich; kh, G. doch. See inside front cover. \*Americanism; †foreign; \*hypothetical; < derived from



[the *current* edition] 3. passing from person to person; circulating (*current* money, *current* rumors) 4. commonly used, known, or accepted; prevalent (a *current* term) —*n.* 1. a flow of water or air, esp. when strong or swift, in a definite direction; specif., such a flow within a larger body of water or mass of air 2. a general tendency or drift; course 3. *Elec.* the flow or rate of flow of electric charge in a conductor or medium between two points having a difference in potential, generally expressed in amperes —*cur'rent-ly adv.* —*SYN.* see PREVAILING, TENDENCY

**current density** the amount of electric current passing through a cross-sectional area (perpendicular to the direction of current) of a conductor in a given unit of time; commonly expressed in amperes per square centimeter or amperes per square inch

**cur-ri-cle** (kur'ī k'l) *n.* [*L. curriculum*: see CURRICULUM] a light, two-wheeled carriage drawn by two horses side by side

**cur-ric-u-lum** (ka rik'yə ləm) *n., pl. -u-la (-lə), -u-lums* [*L., lit., a running, course, race, career* < *currere*, to run; see CURRENT] 1. a fixed series of studies required, as in a college, for graduation, qualification in a major field of study, etc. 2. all of the courses, collectively, offered in a school, college, etc., or in a particular subject —*cur-ric'u-lar adj.*

**curriculum vi-tae** (vit'ē; vē'ti, vē't-) *pl. cur-ric'u-la (-lə) vi'tae* [*L., course of life*] a summary of one's personal history and professional qualifications, as that submitted by a job applicant; résumé

**cur-ri-er** (kur'ē ēr) *n.* [*ME. curriour* < *OFr. corier* < *L. coriarius* < *corium*, hide (see CORIUM): infl. by association with CURRY] 1. a person who carries tanned leather 2. a person who carries horses, etc.

**Cur-rier and Ives** (kur'ē ēr ən ivz') [after Nathaniel Currier (1813-88) & James M. Ives (1824-95), U.S. founders of the lithographing firm that published the prints] any of a 19th-cent. series of prints showing the manners, people, and events of the times

**cur-rish** (kur'ish) *adj.* of or resembling a cur; bad-tempered; mean; ill-bred —*cur'rish-ly adv.*

**cur-ry** (kur'ē) *vt. -ried, -ry-ing* [*ME. curraien* < *OFr. corrier*, *conreder*, to put in order < *VL. \*corredare* < *L. com-*, with + *-red-*, base appearing in *\*arredare*: see ARRAY] 1. to rub down and clean the coat of (a horse, etc.) with a currycomb or brush 2. to prepare (tanned leather) by soaking, scraping, cleaning, beating, etc. 3. to beat or flog —*curry favor* [altered (after FAVOR) < *ME. curraien favel*, to flatter, lit., curry the chestnut horse; *OFr. favel*, chestnut horse (taken as symbol of duplicity) < *dial. form of OHG. falo*, pale, akin to *OE. fealu* (see FOLLOW)] to try to win favor by flattery, fawning, etc.

**cur-ry** (kur'ē) *n., pl. -ries* [*Tamil kari*, sauce] 1. same as CURRY POWDER 2. a sauce made with curry powder 3. a kind of stew prepared with curry —*vt. -ried, -ry-ing* to prepare with curry powder

**cur-ry-comb** (kur'ē kōm') *n.* [*CURRY* + *COMB*] a comb with rows of teeth or ridges, for rubbing down and cleaning a horse's coat —*vt.* to use a currycomb on

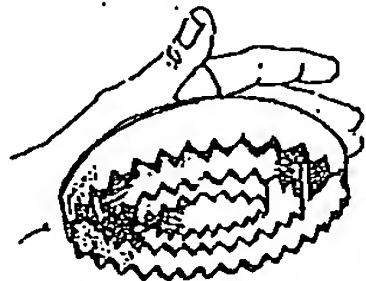
**curry powder** a powder prepared from turmeric and various spices and herbs, used as a seasoning in cooking

**curse** (kɜrs) *n.* [*ME. & Late OE. curs*, *n., cursian*, *v.*: basic sense, ? "wrath" < ? Anglo-Fr. *curuz*, wrath (*OFr. coroz*) + Anglo-Fr. *curcier* (*OFr. corocier*), to call down wrath upon < *VL. \*corruptiare*: see CORRUPT] 1. a calling on God or the gods to send evil or injury down on some person or thing 2. a profane, obscene, or blasphemous oath, imprecation, etc. expressing hatred, anger, vexation, etc. 3. a person or thing that has been cursed 4. evil or injury that seems to come in answer to a curse 5. any cause of evil or injury —*vt.* cursed or cursing 1. to call evil or injury down on; damn 2. to swear at; use profane, blasphemous, or obscene language against 3. to bring evil or injury on; afflict —*vt.* to utter a curse or curses; swear; blaspheme —*be cursed with* to be afflicted with; suffer from —the curse [*Slang*] menstruation, or a menstrual period

*SYN.*—curse is the general word for calling down evil or injury on someone or something; damn carries the same general meaning but, in strict usage, implies the use of the word "damn" in the curse (he damned his enemies = he said, "Damn my enemies!"); execrate suggests cursing prompted by great anger or abhorrence; imprecate suggests the calling down of calamity on someone, esp. from a desire for revenge; anathematize strictly refers to the formal utterance of solemn condemnation by ecclesiastical authority, but in general use it is equivalent to imprecate —*ANT.* bless

**cur-sed** (kur'sid, kɜrst) *adj.* 1. under a curse 2. deserving to be cursed; specif., a) evil; wicked b) detestable; hateful (this cursed cold) 3. [*Archaic*] malevolent; quarrelsome; usually sp. *curs*

**cur-sive** (kur'siv) *adj.* [*ML. cursivus* < *L. cursus*: see COURSE] flowing; not disconnected; specif., designating writing in which the strokes of the letters are joined in each word —*n.* 1. a cursive character 2. a manuscript in cursive



CURRYCOMB

writing 3. *Printing* a type face that looks like handwriting, but with unconnected letters

**cur-so-ri-al** (kər sɔr'ē əl) *adj.* [*< CURSORY + -AL*] Zool. having legs or structural parts adapted for running

**cur-so-ry** (kur'sər ē) *adj.* [*LL. cursorius* < *cursor*, runner < *cursus*: see COURSE] hastily, often superficially, done; performed rapidly with little attention to detail —*SYN.* see SUPERFICIAL —*cur'so-ri-ly adv.* —*cur'so-ri-ness n.*

**curt** (kɜrt) *adj.* [*L. curtus*: for *IE.* base see SHORT] 1. orig., short or shortened 2. brief, esp. to the point of rudeness; terse or brusque (a *curt* reply) —*SYN.* see BLUNT —*curt-ly adv.* —*curt-ness n.*

**cur-tail** (kər tāl') *vt.* [*ME. curtailen*, altered (after *tailen* < *OPr. taillier*: see TAILOR) < *OPr. curtald*, CURTAL] to cut short; reduce; abridge —*SYN.* see SHORTEN —*cur-tail-ment n.*

**cur-tain** (kur'tēn) *n.* [*ME. & OFr. cortine* < *LL. (Ec.) cortina*, lit. a cauldron, hence enclosing circle of a theater (< *IE.* base \*(s)ker-, to CURVE), used in Vulg. instead of *L. cohors*, cohorts (see COURT) to translate Gr. *aulaia*, curtain (esp. in a theater) < *ouli*, open court] 1. a piece of cloth or other material, sometimes arranged so that it can be drawn up or sideways, hung for decoration, as at a window, or to cover, conceal, or shut off something 2. any thing that covers, conceals, or shuts off (a *curtain* of fog) 3. that part of a rampart and parapet between two bastions or gates 4. *Archit.* an enclosing wall that does not support a roof 5. *Theater* a) the large drape or hanging screen at the front of the stage, which is drawn up or aside to reveal the stage b) the opening of the curtain at the beginning, or its closing at the end, of a play, act, or scene c) an effect, line, or situation in a play just before the curtain closes d) same as CURTAIN CALL 6. [*pl.*] [*Slang*] death; the end —*vt.* 1. to provide or decorate with a curtain 2. to cover, conceal, or shut off as with a curtain —draw (or drop) the curtain 1. to end 2. to conceal —lift (or raise) the curtain on 1. to begin 2. to reveal

**curtain call** 1. a call, usually by continued applause, for the performers to return to the stage at the end of a play, act, etc. 2. such a return, acknowledging the applause

**curtain lecture** a private reprimand given by a wife to her husband; so called from the curtained beds in which such reproaches were conventionally given

**curtain raiser** 1. a short play or skit presented before a longer or more elaborate production 2. any brief preliminary event, entertainment, etc.

**curtain speech** a speech delivered from in front of the curtain at the end of a theatrical performance

**curtain wall** an independently supported outer wall that carries only its own weight and is freely removable

**cur-tal** (kur'tl) *adj.* [*OFr. curtald* < *corti*, short < *L. curtus*: see CURT] [*Obs.*] shortened; curtailed —*n.* [*Obs.*] 1. a horse with a docked tail 2. anything cut short or shortened

**curtal ax** [altered < *CUTLASS*] [*Archaic*] a cutlass

**cur-tate** (kur'tāt) *adj.* [*L. curtatus*, pp. of *curtare*, to shorten < *curtus*: see CURT] shortened; abbreviated

**cur-te-sy** (kur'tə sē) *n., pl. -sies* [*var. of COURTESY*] *Law* the right that a husband has in the lands of his dead wife, provided they have had children capable of inheriting

**cur-ti-lage** (kur'tl'ij) *n.* [*ME. < OFr. cortillage* < *cortil*, dim. < *ML. cortis*, COURT] *Law* the fenced-in ground and buildings immediately surrounding a house or dwelling

**Cur-tis** (kur'tis) [*< ONormFr. curteis* (*OFr. corleis*): see COURTEOUS] a masculine name

**Cur-tiss** (kur'tis), Glenn Hammond 1878-1930; U.S. aviator & pioneer in aircraft construction

**curt-sy** (kur'tsē) *n., pl. -sies* [*var. of COURTESY*] a gesture of greeting, respect, etc. made, esp. formerly, by girls and women and characterized by a bending of the knees and a slight lowering of the body —*vi. -sted, -sy-ing* to make a curtsy Also sp. *curt'sey*

**cu-rule** (kyoor'ool) *adj.* [*L. curulis* < *currus*, chariot, akin to *currere*, to run; see CURRENT] 1. designating a chair like an upholstered campstool with heavy curved legs, in which only the highest civil officers of Rome were privileged to sit 2. privileged to sit in a curule chair; of the highest rank

**cur-va-ceous** (kər vā'shəs) *adj.* [*CURY* (E) + *-ACEOUS*] [*Colloq.*] having a full, shapely figure: said of a woman

**cur-va-ture** (kur'və chər) *n.* [*ME. < L. curvatura* < *curvare*: see CURVE] 1. a curving or being curved 2. a curve; curved part of anything 3. *Geom.* the rate of deviation of a curve or curved surface from a straight line or plane surface tangent to it 4. *Med.* an abnormal curving of a part (*curvature* of the spine)

**curve** (kɜrv) *adj.* [*L. curvus*, bent < *IE.* base \*(s)ker-, to turn, bend, whence Gr. *korónos* (cf. CORONA), Mfr. *cor*, circle] [*Archaic*] curved —*n.* 1. a line having no straight part; bend having no angular part 2. a thing or part having the shape of a curve 3. the act of curving, or the extent of this 4. [*pl.*] the pronounced curving outline of a shapely female figure 5. *Baseball* a pitched ball thrown with spin so that it curves to the opposite side before crossing the plate 6. a curved line or similar graphic representation showing variations occurring or expected to occur in prices, business conditions, group achievements, etc. 7. *Math.* a one-dimensional continuum of points in a space of two or more dimensions, such as a parabola in a plane or a helix in three-dimensional space —*vt., vi.* curved, curv'ing 1. to form a curve by bending 2. to move in a curved path



**Howrah** (hou'ra) city in S West Bengal, India, on the Hooghly River, opposite Calcutta: pop. 513,000  
**how-so-ev-er** (hou'sō ev'ər) *adv.* [ME. *hou so evere*] 1. to whatever degree or extent 2. by whatever means; in whatever manner  
**how-to** (hou'tō) *adj.* [*< phrase how to make (or do) something*] [Colloq.] giving elementary instruction in some handicraft, hobby, etc. (a *how-to* book)  
**hoy** (hoi) *n.* [ME. *hoye* < MDu. *hoel*] 1. a former type of small fore-and-aft-rigged vessel resembling a sloop 2. a heavy barge  
**hoy!** (hoi) *interj.*, *n.* [ME.] an exclamation to attract attention, drive hogs, etc.  
**hoy-den** (hoid'n) *n.* [Early ModE., a rude fellow < ? Du. *heiden*, HEATHEN] a bold, boisterous girl; tomboy —*adj.* bold and boisterous; tomboyish —*vi.* to behave like a hoyden —*hoy-den-ish* *adj.*  
**Hoyle** (hoil) *n.* a book of rules and instructions for indoor games, esp. card games, orig. compiled by Edmond Hoyle (1672–1769), English authority on card games and chess —according to Hoyle according to the rules and regulations; in the prescribed, fair, or correct way  
**HP**, **H.P.**, **hp**, **h.p.** 1. high-powered 2. high pressure 3. [Brit.] hire purchase 4. horsepower  
**HQ**, **H.Q.**, **hq**, **h.q.** headquarters  
**hr.** *pl.* hrs. hour; hours  
**H.R.** 1. Home Rule 2. House of Representatives  
**h.r.**, **hr.** HR home run  
**Hra-dec** Krá-lo-vé (hrá'dets krá'ld ve) city in Bohemia, NW Czechoslovakia; in a battle at nearby Sadová (1866) the Prussians defeated the Austrians: pop. 62,000  
**Hr-dlič-ka** (hur'dlich ka), **A-leš** (á'lesh) 1869–1943; U.S. anthropologist, born in Bohemia  
**H.R.H.** 1. Her Royal Highness 2. His Royal Highness  
**Hroll** (rǎll, rǒll) *see* ROLL  
**H.S.**, **h.s.** high school  
**Hsia-men** (shyá'mun') *same as* AMOY  
**H.S.M.** 1. Her Serene Majesty 2. His Serene Majesty  
**HT** high tension  
**ht**, 1. heat 2. *pl.* hts. height  
**HUAC** (hōō'ak', hyōō'-) House Un-American Activities Committee  
**hua-ra-ches** (hə rā'chēz; *Sp.* wā rā'ches) *n.pl.* [*pl. of MexSp. huarache*] flat sandals whose uppers are made of straps or woven leather strips  
**Huá-car** (wās'kár) 1495?–1533; Inca king of Peru, deposed by his half brother Atahualpa  
**Huá-ca-rán** (wās'kā rán') mountain of the Andes, in WC Peru: 22,205 ft.  
**Huá-tec** (wās'tek) *n.* [*< native name*] 1. a member of a tribe of Mexican Indians living in N Veracruz and adjacent states 2. their Mayan language  
**hub** (hub) *n.* [prob. ult. < IE. base \**heu-*, to bend, mound, boss; ? akin to *HOV*: cf. *HIGH*, *HOBBLE*] 1. the center part of a wheel, etc., the part fastened to the axle, or turning on it 2. a center of interest, importance, or activity —the Hub Boston: a nickname  
**Hub-bard** squash (hub'ərd) a hard winter squash with a green or yellow rind and firm, yellow flesh  
**hub-ble-bub-ble** (hub'l bub'l) *n.* [echoic] 1. a tobacco pipe in which the smoke is drawn through water, causing a bubbling sound; simple type of hookah 2. a bubbling sound 3. hubbub; uproar  
**hub-bly** (hub'li) *adj.* [Colloq.] rough or bumpy; uneven  
**hub-bub** (hub'ub) *n.* [prob. < Celt., as in Gael. *ubub*, exclamation of aversion] a confused sound of many voices; uproar; tumult —*SYN.* see NOISE  
**hub-by** (hub'ē) *n., pl. -bies* [Colloq.] a husband  
**hub-cap** (hub'kap') *n.* a tightfitting metal cap for the hub of a wheel, esp. of an automobile  
**Hu-ber** (hyōō'bər) (Fr. < OHG. *Huguberht*, lit., bright (in) spirit < *hugu*, mind, spirit + *beraht*, BRIGHT) a masculine name; equiv. It. *Uberto*  
**Hub-li** (hoob'li) city in Mysore state, SW India: pop. 171,000  
**hu-bris** (hyōō'bris) *n.* [Gr. *hybris* < IE. *ud-*, up (cf. *OUT*) + \**gweri-*, heavy; basic sense prob. "to rush at impetuously"] wanton insolence or arrogance resulting from excessive pride or from passion —*hu-bris-tic* *adj.*  
**huck-a-back** (huk'a bak') *n.* [*< ?*] a coarse linen or cotton cloth with a rough surface, used for toweling; also huck  
**huck-le** (huk'li) *n.* [dim. (see -LE) of obs. *huck* in same sense; ? akin to ON. *hūka*, to crouch < same IE. base as *HIP*] [Archaic] the hip or haunch  
**huck-le-ber-ry** (huk'li ber'ē) *n., pl. -ries* [prob. altered < *HURTLEBERRY*] 1. any of a genus (*Gaylussacia*) of plants of the heath family, having dark-blue berries resembling blueberries, but with ten large seeds 2. the fruit of any of these shrubs 3. loosely, a blueberry  
**huck-le-bone** (-bōn') *n.* [see *HUCKLE*] [Archaic] 1. the hipbone 2. the anklebone; talus  
**huck-ster** (huk'stər) *n.* [ME. *hokstere* < MDu. *hockster* < *hocken*, to peddle, akin to G. *hökern*: see *HAWKER*] 1. a peddler or hawker of wares, esp. of fruits, vegetables, etc. 2. an aggressive or haggling merchant, esp. one who uses questionable methods 3. [Colloq.] a person engaged in advertising, esp. for radio and television —*vi.* 1. to peddle or sell 2. to sell or advertise in an aggressive, questionable way —*huck'ster-ism* *n.*

**HUD** (Department of) Housing and Urban Development  
**Hud-dera-field** (hud'ərz fēld') city in SW Yorkshu England: pop. 132,000  
**hud-dle** (hud'l) *vi.* -dled, -dling [orig. (16th c.), out of sight, prob. var. of ME. *hoderen* in same sense to *hide*] 1. to crowd, push, or nestle close together  
**huddle** (hudl) *n.* 1. a crowd or hunch oneself up, a cold (to huddle under a blanket) 2. to hold a private informal conference 3. Football to gather in a huddle 4. to crowd close together 5. to hunch or (oneself) up 6. to do, put, or make hastily and carelessly 7. to push or thrust in a hurried or disordered manner 8. 1. a confused crowd or heap of persons or things 2. confusion; muddle; jumble 3. [Slang] a private formal conference 4. Football a grouping of a behind the line of scrimmage to receive signals before:  
**Hu-dl-bras-tic** (hyōō'də bras'tik) *adj.* like, or in the of, Samuel Butler's *Hudibras*, a mock-heroic satirical (1663–78) in tetrameter couplets, ridiculing the Puritans  
**Hud-son** (hud'sn) [after Henry HUDSON] river in E flowing southward into Upper New York Bay: c. 31 miles long  
**Hudson** 1. Henry, ?–1611; Eng. explorer, esp. of the N about NE N. America 2. W(illiam) H(enry), 1841–1911; Eng. naturalist & writer  
**Hudson Bay** [after Henry HUDSON] inland sea in Canada; arm of the Atlantic: c. 475,000 sq. mi.  
**Hudson seal** muskrat fur processed to resemble sea  
**Hudson Strait** strait in NE Canada, connecting Hudson Bay with the Atlantic: c. 430 mi. long; 37–120 mi. wide  
**Hue** (hwā, wā) city in N South Vietnam, on the S China Sea: pop. 104,000  
**hue** (hyōō) *n.* [ME. *hewe* < OE. *heow*, akin to Goth. *hewjan*, to cut; IE. \**h₂u-* < base \**h₂u-*, (dark-ened, whence OE. *hæwen*, blue, *har*, HOAR) 1. orig., appearance; aspect 2. color; esp., the distinctive characteristics of a given color that enable it to be assigned a position in the spectrum 3. a particular shade or tint of a color —*SYN.* see COLOR  
**hue** (hyōō) *n.* [ME. *hu* < OPr., a warning interjective shouting; outcry: now only in fl. phrase —hue and [Anglo-Norm. *hu'eri*] 1. orig., a loud shout or cry those pursuing a felon: all who heard were obliged to in the pursuit 2. the pursuit itself 3. any loud out or clamor  
**hued** (hyōōd) *adj.* [ME. *hewed*, pp. of *heowien*, to color OE. *heowan* < *heow*: see *HUE*] having some (special shade or intensity of color or (a specified number colors) rosy-hued, many-hued  
**huff** (huf) *vt.* [prob. echoic] 1. orig., to blow, swell, or up 2. to treat insolently; bully; Hector 3. to make any offend —*vi.* 1. to blow; puff 2. to become angry; to offend 3. [Obs.] to swell with pride or arrogance —condition of smoldering anger or resentment  
**huff-lah** (-lah) *adj.* [BUFF + -lah] 1. peevish; petulant 2. [Obs.] inclined to be arrogant —*huff-lah-ly* *adv.* —*huff-lah-ness* *n.*  
**huff-y** (ē) *adj.* huff'ler, huff'ler 1. easily offend touchy 2. angered or offended 3. [Obs.] arrogant —*huff-y-ly* *adv.* —*huff-y-ness* *n.*  
**Hu-fuf** (hoo fōōf') *same as* HOFUF  
**hug** (hug) *vt.* hugged, hug'ing [prob. via dial. < C *huggo*, to comfort, console] 1. to put the arms around and hold closely; esp., to embrace tightly and affectionately 2. to squeeze tightly between the forelegs, as a bull does 3. to cling to or cherish (a belief, opinion, etc.) 4. keep close to (to hug the shoreline in sailing) —*vi.* to clasp or embrace one another closely —*n.* 1. a close, affectionate embrace 2. a tight clasp or hold with the arms, as wrestling 3. a bear's squeeze  
**huge** (hyōōj, yōōj) *adj.* [ME. < OPr. *ahuge*, *ahoge*] very large; gigantic; immense —*SYN.* see ENORMOUS —*huge-ly* *adv.* —*huge-ness* *n.*  
**hug-ger-mug-ger** (hug'ər mug'ər) *n.* [earlier also *hok maker*, apparently rhyming compound based on M. *mokeren*, to hoard, conceal, whence the basic sense "secret"] 1. a confusion; muddle; jumble 2. [Archaic] secret —*adv.* 1. in a confused or jumbled manner 2. [Archaic] secretly —*vi.* to keep secret —*vi.* to behave in a secretive or confused way  
**Hugh** (hyōō) [OPr. *Hue* < OHG. *Hugo*, prob. < *hug* heart, mind] a masculine name; var. *Hugo*  
**Hugh Capet** *see* HUGH CAPET  
**Hughes** (hyōōz) 1. Charles Evans, 1862–1948; U.S. statesman & jurist; chief justice (1930–41) 2. (James) Langston (Jan'stən), 1902–67; U.S. poet & writer 3. Thomas, 1822–96; Eng. writer & social reformer  
**Hu-go** (hyōō'gō; for 2, also Fr. ü gō) 1. a masculine name —see *HUGO* 2. Vic-tor Ma-rie (vēk tōr' mā rē'), 1802–83; Fr. poet, novelist, & playwright  
**Hu-gue-not** (hyōō'gə nāt') *n.* [MFr., orig., supporter of group in Geneva opposing annexation to Savoy; altered (after *Hugues* Besançon, leader of the group) < earlier *cidnot* < G. *eidgenosse*, a confederate, ally; name later applied to Protestants in reference to the Calvinist Reformation in Geneva] any French Protestant of the 16th or 17th century  
**huh** (hu, hun) *interj.* an exclamation used to express contempt, surprise, etc., or to ask a question





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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
APPLICATION FOR UNITED STATES LETTERS PATENT

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TITLE: Wheel Hub with Clutch

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## **WHEEL HUB WITH CLUTCH**

This is a continuation of application number 09/840,778, filed April 25, 2001.

### **BACKGROUND OF THE INVENTION**

#### **1. Field of the Invention**

5       The present invention relates to wheel hubs and primarily bicycle type wheel hubs with clutches where the hub is free wheeling when torque is not being applied to the hub through a gear that is linked by a chain to a peddle arrangement, and will engage to transfer torque to a hub wheel when torque is applied to the peddle assembly.

#### **2. Prior Art**

10       Wheel hubs having clutches capable of free wheeling when a torque is not being applied thereto, as through a chain linked to a peddle arrangement, or like driving arrangement, but will engage to transmit torque to turn a hub wheel as generated by an operator turning such peddle arrangement are, of course, well known, and are in common use. For example, on bicycles that are directly driven through a single gear, or include multi-speed gearing. One such earlier hub  
15       design, that is believed to be the basic design of most earlier hubs for use with multi-speed gearing, is shown in FIGS. 1, 2A and 2B and is described as prior art in the Detailed Description portion of this application. This earlier hub, unlike the invention, is a ratchet type design that includes an annular ring gear that has its outer circumference secured to the inner wall of a hub body and includes teeth or notches formed around the ring gear inner circumference that slope in  
20       the direction of turning of the hub body when it is free wheeling, and includes pawls that are spring biased and are connected to extend outwardly at spaced intervals from around a peddle assembly that each have a tooth end. In free wheeling operations, the outwardly biased pawl tooth ends will each travel up the slope of each ring gear tooth or annular notch, and with the

spring biasing to extend each pawl tooth end to cause the pawl end to travel down the tooth or annular notch face and engage the next tooth or annular notch face. Thereby, when the peddle assembly is turned, that turning will be against the slope of the ring gear teeth or annular notch, and the pawl tooth ends will engage and bind against the ring gear teeth faces or annular notches, transmitting an applied torque through the ring gear and into the wheel hub body to drive the wheel.

The above described spring-actuated ratchet type design for a hub clutch has, since the early nineteen hundreds, been the standard for over-running wheel hub transmissions. In practice, such spring-actuated ratchet type design provides a torque transfer from a peddle assembly, or the like, to turn a wheel at the expense of reliability and durability and accordingly necessitates high-maintenance costs. This is because the hub clutch components, specifically the pawls and their springs, are exposed to high cyclical fatigue and are therefore failure prone. Such failure is characterized by cracked pawls, or broken or bent springs. Typically, in the event of a failure of only one of the springs or pawls, a typical lightweight, high performance wheel hub will suffer a rapid deterioration of the remaining spring pawl components, resulting in total hub failure.

Additionally, earlier systems as have employed ball bearing assemblies for power transfer through a hub to turn a wheel have not included a series of spaced pockets that each incorporates a sloping side configuration like that of the invention and have required that each ball bearing carry both a radial load, that is applied perpendicular to the bearing assembly, and axial loads as are transmitted through the axle. In such earlier systems, higher friction forces have resulted from a scrubbing of the bearing surface as occurs at the portion of the ball bearing that carries radial loads with the bearing portion as supports radial loads tending to rotate faster than the ball



bearing portion that is carrying thrust loads. In the invention, radial loads are contained and carried at an annular race and seat portion wherein the spaced sloping pockets of the hub assembly are formed, and the hub assembly preferably includes a separate axle thrust bearing or bearings that incorporate radially spaced needle bearings to support axial loads.

5 Unlike earlier wheel hub designs, the hub of the invention will not deteriorate when exposed to cyclical fatigue, in that it does not include the vulnerable and unreliable spring biased pawls, but rather employs a unique combination of hub body race arrangement that is formed as spaced sloping pockets and opposing annular ring that includes spaced cup or step segments with ball bearings installed into which opposing sloping pockets and cup or step segments, providing  
10 immediate engagement upon receipt of a torque or turning force.

#### **SUMMARY OF THE INVENTION**

The invention is in a wheel hub constructed to provide low rolling resistance, greater load carrying capacity with enhanced torque transmission that is more reliable and will therefore operate reliably at less cost. The hub is free-rolling, providing over-running in a clock-wise or  
15 forward turning direction, but provides a nearly instantaneous clutch locking when a peddle or like drive force is applied thereto, as through a chain. So arranged, nearly instantaneous torque transfer is provided through the hub, as when the hub of the invention is in use with a bicycle driven wheel. The hub of the invention facilitates torque transfer through a multitude of ball bearings that are each housed in contoured pockets that interface with an opposing face of an  
20 annular ring of the hub body whereto a wheel is supported through spokes, ribs, or the like. The clutch bearing system of the invention is to carry a radial load that is the load that results perpendicular to the hub as from a road surface, with the applied loads transferred through a coupling of the hub outer and annular sections.

For the wheel hub clutch of the invention, the hub outer section pockets slope rearwardly from a greater to lesser height in a direction that is counter to the direction of the applied torque. Thereby, when torque is applied in the direction of hub free-wheeling, ball bearings maintained in the hub pockets will each instantly travel opposite to the applied torque, and travel upwardly  
5 along the pocket slopes towards the pockets lesser height sections, traveling upwardly along the pocket slope to bind against the ring steps. In clutch operation, the hub interior and exterior sections are thereby connected at multiple points therearound, equally distributing the applied torque through as many as ten ball bearings.

For carrying axial loads that are parallel to the road surface and are transmitted through  
10 the axle, the invention can include at least one thrust bearing fitted between the hub interior and exterior sections that includes a pair of like disk shaped plates that are fitted together and have radially spaced cylindrical openings that align as pairs to each receive a needle bearing journaled therein. In the invention, applied radial and axial loads are supported by the combination of ball and needle bearings that operate in conjunction with standard roller bearings as are fitted  
15 between a stationary axle and support the hub whereto a rim is mounted, as through spokes, or like arrangement.

It is a principal object of the present invention to provide a hub clutch bearing assembly that provides for a nearly instantaneous coupling of hub inner and annular sections across ball bearings for transferring torque from the hub inner section to the outer section whereto a wheel  
20 rim is secured.

Another object of the present invention is to provide a wheel hub clutch consisting of inner and outer hub sections, with the inner section for mounting to an axle that is turned by a peddle arrangement to transfer torque thereto, and with the inner section including a ring having

spaced contoured pockets formed therearound that are each fitted with a ball bearing, and with the hub outer section including an annular ring having spaced steps sections, and with each ball bearing to nest and bind between a pocket surface and a ring step, transferring torque thereacross.

5        Another object of the present invention is to provide the inner ring with contoured pockets that slope upwardly from a deep section in the direction of wheel turning, whereby each ball bearing, at peddle turning, will roll oppositely to the direction of peddle turning, traveling upwardly along the pocket contour and into engagement with an adjacent ring step, causing the ball bearing to bind therebetween, transferring torque from turning the peddle arrangement into  
10    the turning hub outer section.

Another object of the present invention is to provide a wheel hub that will present a minimum rolling resistance in a free-wheeling mode and includes a clutch that will nearly instantly and positively connect to transmit torque when a peddle arrangement is turned, and will quickly disengage when a peddle turning force is removed.

15        Another object of the present invention is to provide a wheel hub clutch where engagement of hub inner and outer sections is through a plurality of ball bearing where the ball bearings each turn between engagements and thereby preclude scuffing of the ball surface over time and repeated couplings.

Still another object of the present invention is to provide a wheel hub where hub inner  
20    and outer section coupling is through ball bearings for supporting road forces as are directed perpendicularly into the hub, with the hub further including at least one thrust bearing fitted between the hub sections for supporting side or axial loads.

Still another object of the present invention is to provide a thrust bearing that consists of needle bearings that are mounted radially in a disk shaped body that is open through its center to receive an axle fitted therethrough, with the thrust bearings to support side or axial loads as are directed into the hub.

5        Still another object of the present invention is to provide a wheel hub clutch that is simple and economical to manufacture and will provide a sure and nearly instantaneous engagement to transfer torque, as from a turning peddle arrangement, to turn a wheel whereto the hub is mounted

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

10        These and other objects and features of the present invention will become more apparent from the following description in which the invention is described in detail in conjunction with the accompanying drawings:

FIG. 1 is a side and end elevation exploded perspective view of a hub and axle that is identified as Prior Art;

15        FIG. 2A is an end sectional view of the assembled hub of FIG. 1 taken across a hub coupling end showing spring biased pawls ratcheting over teeth apexes of a hub outer portion annular ring section when the hub is free-wheeling, and the peddle assembly is not being turned to produce a drive torque;

FIG. 2B is a view like that of FIG. 2A showing the pawls in engagement with the sides of  
20        the annular ring teeth when the peddle assembly is turned by an operator, producing a drive torque;

FIG. 3 is a side elevation perspective view of a hub of the invention shown arranged as a bicycle hub that includes spoke holes that are for securing spoke ends therein;



FIG. 4 is a side elevation exploded perspective view of the hub of FIG. 3;

FIG. 5 is a longitudinal sectional view of the hub of FIG. 3, shown as having been assembled and whereto spokes have been attached to form a wheel, such as a bicycle wheel, showing the hub axle supported to the hub between pairs of conventional roller bearing and

5 showing the hub clutch as including inner and outer annular sections, with roller bearings fitted in contoured pockets or the hub inner section and to engage adjacent to stepped portions of an annular ring of the hub outer section, and showing the hub clutch sections separated by a thrust bearing;

FIG. 6A is an enlarged end sectional view taken along the line 6A-6A of FIG. 5, showing  
10 the assembled clutch load bearing and torque transfer system in a free-wheeling attitude;

FIG. 6B is a view like that of FIG. 6A showing the roller bearings in the hub inner section pockets as having been moved outwardly, responsive to axial turning, and have traveled along the pocket tracks into engagement with the stepped portions of an annular ring of the hub outer section;

15 FIG. 6C is a view like that of FIG. 6B showing the roller bearings as having fully moved into binding engagement between the hub inner section pockets and the hub outer section stepped portions, transferring an applied torque thereacross;

FIG. 7 shows a front end and side perspective view of a mountain bicycle having a gear operated peddle and chain torque transfer arrangement that the wheel hub of the invention is  
20 suitable for installation on; and

FIGS. 8A, 8B, 8C and 8D are views like that of Gigs. 6A, 6B and 6C only showing alternative arrangements of the hub out section stepped portions.

## DETAILED DESCRIPTION

The invention, as is hereinafter described, relates to wheel hubs that remain unengaged or free-wheeling during a coasting mode where, torque is not being applied to turn the wheel in a clockwise direction, and includes a clutch that will immediately engage to transfer torque from a clockwise turning of the hub inner portion or section, for transferring torque across the hub and into the wheel mounted onto the hub.

FIG. 1 shows an exploded perspective view of a hub 10 and axle 11 that is identified as Prior Art and is here included to illustrate what has been and is currently a market standard of a wheel hub with clutch. Shown in FIG. 1, the hub 10 includes a center sleeve 12 that has up-  
turned flange ends 13a and 13b that each have spaced holes 14 formed therearound to receive ends of spokes, not shown, fitted thereto to form a wheel, such as a bicycle wheel like the wheel 89 that is shown fitted to a bicycle 85, as shown in FIG. 7. Shown in FIG. 1, the hub center sleeve 12 is stepped inwardly from flange end 13a into a collar 15 having a flat outer end 16 that is open and is itself stepped to receive and seat a roller bearing 17a fitted therein. The roller bearing 17a is open across its center to receive axle 11 that has traveled through the center sleeve 12 and is fitted therethrough, with the axle end 11 a to receive an end cap 18a turned thereover. A gear spline sleeve 20 clutch end 21 is shown aligned to fit into a driver end 22 of sleeve 12, as shown best in FIGS. 2A and 2B, and as is discussed herein below. The gear spline sleeve 20 includes like parallel spaced bars 23 that are fixed longitudinally to the sleeve outer surface 24 and are to receive the contours of the open center of gears fitted thereover as a stack, with a greatest diameter gear preferably arranged closest to the sleeve 12 flange end 13b. A standard bicycle chain, like chain 87 of FIG. 7, is fitted over one of the gears. In operation, the chain 87 of FIG. 7 is moved across the gears, changing the speed of turning of the hub 10 and connected

wheel responsive to operation of a derailier assembly. The hub 10 is assembled by fitting the axle 11 through a center opening formed through roller bearing 17b that, in turn, is fitted in an outer opening 25 of the gear spline sleeve 20. The axle 11 is passed through the gear spline sleeve 20, center sleeve 12, that includes the collar 15, and through the roller bearing 17a, and is to receive the cap 18a turned thereover. A cap 18b, that is like cap 18a, is turned over the axle end 11b, finishing the assembly of the hub 10 and axle 11 that is then installed to a bicycle frame as the rear wheel.

The hub 10, is assembled as described above, to provide a spring actuated ratchet such that, as shown in FIG. 2A and 2B, and includes an annular ring that is formed with identical spaced teeth 26, as shown in FIG. 1, that are secured to the inner surface of the sleeve 12, adjacent to the sleeve flange end 13b. Shown in FIGS. 2A and 2B. each tooth 27 of teeth 26 slopes uniformly outwardly from a based end 28 to an apex wherefrom a flat face 29 extends downwardly. The teeth 26 oppose a number of spaced pawls 30 that are fitted in slots 33 and are spaced to be equidistant from one another and to extend outwardly from around the outer surface of the gear spline sleeve 20 clutch end 21, as shown in FIG. 1. The pawls 30 are each fitted into a slot 33, and a base end of each pawl is mounted at a pivot 32 so as to extend outwardly, under the biasing of sear springs 31, as shown in FIGS. 2A and 2B. So arranged, with a wheel mounted to the hub sleeve 12 turning clockwise in a free-wheeling attitude, as illustrated in FIG. 2A, each pawl 30 rides up each tooth 27, extending down the tooth face 29 to engage the next tooth 27 base end 28, with the pawls 30 thereby ratcheted along the teeth 26. When, however, the gear spline sleeve 20 is turned clock-wise, as by action of the bicycle chain 87 acting through one of the gears splined thereon during operation of the bicycle peddle assembly, the pawls 30 outer

ends each engage a tooth 27 face 29, as shown in FIG. 2B, locking the gear spline sleeve 20 to the hub sleeve 12, to transfer torque from the peddle assembly to the bicycle wheel.

Like the described torque transferring hub 10, the invention is in a torque transferring hub 40, hereinafter referred to as hub that operates as a clutch for transferring torque into a wheel that the hub is part of. Such torque is generally passed through a chain drive to a gear, illustrated as chain 87 and gears 88 in FIG. 7. Which gear or gears 88 are splined onto a gear spline sleeve 42 that connects, end to end, to a center sleeve 41 whereto ends of wheel spokes are fitted at spaced intervals to extend from around the center sleeve, as shown in FIG. 5. In outer appearance, the hub 40, as shown in FIG. 3, has an appearance that is similar to the prior art hub 10. Shown best in FIG. 4, the hub 40 includes a center sleeve 41 with ends wherefrom flange plates 43a and 43b extend outwardly and are essentially parallel and include, respectively, holes 44 formed at spaced intervals therethrough that are for receiving spoke ends, forming a wheel like the rear wheel 89 of the bicycle 85 of FIG. 7. An axle 45, that is threaded on its ends 45a and 45b, is for fitting through, to hold together, the hub 40 components and to mount the hub 40 to a bicycle rear frame. End caps 46a and 46b are provided that are turned onto the axle threaded ends 45a and 45b to hold the hub 40 together, as set out herein with respect to a description of the assembly of hub 40.

Shown in the exploded view of FIG. 4, and the assembled longitudinal sectional view of FIG. 5, the hub 40 of the invention, like the hub 10, is for fitting onto axle 45. The hub includes the gear spline sleeve 42, that has parallel longitudinal spaced bars 45 projecting outwardly from around a sleeve cylindrical outer surface 46. Which the spaced bars 45 each have a right triangular cross section to accommodate a center hub configuration of at least one, and preferably a stack, of driven gears, like the stack of gears 88 of the bicycle 85, as shown in FIG.

7. The gear spline sleeve 42, shown in FIG. 4, is open therethrough and includes, on an upper end, a threaded end collar 47 for receiving and mounting a ring 48 that is internally threaded at 48a for turning thereover to maintain gears 88 on the gear spline sleeve 42. The collar 50 is fixed to one end section of an axle bearing sleeve 49, just back from a flat circular disk 52 that is treaded to receive an internally threaded lower end of the gear spline sleeve 42 turned thereon. The flat circular disk 52 includes inner face 53 that contains one of two sides of a torque transfer clutch of the invention, as set out below. The axle bearing sleeve 49 is stepped internally at opposite ends to receive standard roller bearings 55c and 55d, to be fitted therein that are open across their centers to allow passage to and to support the axle 45 fitted therethrough, as shown in FIG. 5.

Shown in FIG. 4, the assembled view of FIG. 5, and FIGS. 6A, 6B and 6C, the axle bearing sleeve 49 end that is adjacent to the flat circular disk face 53 is a thick ring 56 having a series of like contoured pockets 57 formed around its outer surface. Each pocket 57 has a forward pocket section 58 formed to seat a ball bearing 59 therein and tapers upwardly from the forward pocket section 58 as a track 58a that the ball bearing 59 will roll along from forward pocket section 58. So arranged, the ball bearings 59 will travel outwardly along the track 58a, when the thick ring 56 is turned in a clock-wise direction. Which turning is provided by a turning of the gear spline sleeve 42 that is turned by a turning of a gear that is splined thereon and whereover a chain, like the chain 87 shown in FIG. 7, is fitted.

Shown in FIG. 4, the center sleeve 41 flange plate 43a, wherein spaced holes 44 are formed that receive ends of spokes fitted thereto, includes a center cup section 60 that is open across a bottom end into an axle passage 61. The center cup section 60 has an adjacent wall 62 that is parallel to the flat circular disk 52 thick ring 56 face, and, when the hub 40 is assembled,

will function as the other of the two sides containing the torque transfer clutch of the invention.

The center cup section, shown in FIG. 4 and FIGS. 6A, 6B and 6C, includes a series of like spaced ring steps 63 as an outside wall 62 of the center cup section 60, and provides a center sleeve 41 annular ring that opposes the contoured pockets 57 of the assembled hub 40. A

5 plurality of ball bearings 59 are shown fitted into the spaced ring steps 63 as they would be positioned when the clutch is engaged to transfer torque therethrough.

In the assembly view of FIG. 5, the ball bearings 59 are shown fitted into so as to span between the contoured pockets 57 and the ring steps for locking the gear spline sleeve 42 and center sleeve 41 together, transferring torque into the wheel mounted onto the center sleeve 41.

10 This locked state of the gear spline sleeve 42 and center sleeve 41 continues until torque is removed from the gear spline sleeve 42 as when an operator discontinues turning the peddle arrangement with their feet, and allows the wheel 89 to free-wheel. In which free-wheeling, the wheel 89 continues turning in the direction of gear spline sleeve 42 turning, with the ball bearings 59, when not under torque, tending to roll away from the ring steps 63, along the

15 contoured pockets 57 sloping tracks 58a and back into pocket forward sections 58. Which ball bearing 59 travel disengages torque transfer and is essentially immediate when the operator discontinues peddle turning. Likewise, hub 40 engagement is essentially immediate when an operator turns the peddle arrangement to pass the chain 87 around the gear that is connected to the gear spline sleeve 42. It is the gear spline sleeve 42 turning causes the ball bearings 59 to roll

20 back along the contoured pockets 57 sloping tracks 58a and into engagement with engage a ring step 63. As the ball bearings 59 tend to roll in the contoured pockets during free-wheel the engaging surfaces of each of the ball bearings will vary between each engagement, avoiding ball scoring at points of scuffing as has occurred with earlier systems, greatly extending unit life.



[0039] FIG. 6A shows the hub 40 in a free-wheeling attitude, the flange plate 43a of the center sleeve 41 turning as illustrated by arrow A, as when the bicycle 85 is coasting and the peddle assembly 86, shown in FIG. 7, is not turning. So arranged, gear spline sleeve 42, whereto is connected the thick ring 56 with the spaced contoured pockets 57 formed therein, is stationary,  
5 and the ball bearings 59 rest in the contoured pockets forward sections 58.

FIG. 6B shows the hub 40 of FIG. 6A with arrow B indicating a turning of the gear spline sleeve 42 as through chain 87, that is linked to the peddle assembly 86 of the bicycle 85 of FIG. 7. Which gear spline sleeve 42 is turned, as indicated by arrow B, in the direction of wheel rolling, shown as arrow A in FIG. 6A, and causes the ball bearings 59 to roll oppositely to the  
10 direction of turning, traveling upwardly along the sloping tracks 58a to contact a ring step 63 surface. Which ball bearing 59 travel is a very short distance providing essentially an immediate coupling of the respective gear spline sleeve 42 and center sleeve 41 of the flange plate 43a to transfer an applied torque thereacross and turn the wheel 89, shown in FIG. 7.

FIGS. 6A and 6B show the cavity between gear spline sleeve spaced pockets 57 and ring  
15 step 63 surface as accommodating three ball bearings 59. Whereas, FIG. 6C shows ten ball bearings 59, arranged one in each gear spline sleeve contoured pocket 57. The FIGS. 6A, 6B and 6C to illustrate that as few as three and as many as a ball bearing for each pocket 57 can be so used to provide for rapid and sure locking together and separation of the gear spline sleeve 42 of the flange plate 43a and center sleeve 41 for transferring torque from a peddle assembly into a  
20 wheel.

Additionally, where FIGS. 6A, 6B and 6C all show the gear spline sleeve 42 as including the ring step 63 surface, FIGS. 8A, 8B, 8C and 8D are included to illustrate other surface configurations of the center sleeve 42 that can be utilized with the described gear spline sleeve

contoured pockets, within the scope of this disclosure. Shown in the side elevation view of FIGS. 8A, 8B, 8C and 8D, a flange plate 143a has center sleeve surfaces 163a, 163b, 163c and 163d that are opposed, respectively, by gear spline sleeve contoured pockets 157. Which gear spline sleeve contoured pockets 157 are each formed in thick ring 156 that, respectively, include forward pocket sections 158 that each slope upwardly at 158a so as to accommodate ball bears 159, as shown in broken lines. The center sleeve surfaces 163a, 163b, 163c and 163d, respectively, illustrate alternative surface configuration to the ring steps 63 of FIGS. 6A, 6B and 6C, and are herein includes as examples of alternative surfaces capable of engaging and binding to the surface of a ball bearing as is contained in a contoured pocket 57 or 157, of FIGS. 6A, 6B and 6C and 8A, 8B, 8C and 8D. Thereby illustrating that the center sleeve surface can be any appropriate surface within the scope of this disclosure.

The above set out description of the components of and function of the hub clutch of the invention for providing a rapid coupling and uncoupling the gear spline sleeve 42 and center sleeve 41 provides for a transfer of road forces as are perpendicular to the road surface. Additionally, the hub 40, for minimizing friction as is directed through the axle 45, and are essentially perpendicular to road forces, preferably includes a thrust bearing 70, as shown best in FIGS. 4 and 5, that is installed in the center sleeve 41 center cup section 60. The preferred thrust bearing 70, as shown, has a thin disk shaped body 71 that is open across a center opening 72 to align with the axle opening 61, and with one flat side of the thrust bearing body 71. As shown best in FIG. 5, the thrust bearing 70 is arranged to fit against roller bearing 55b and contact, around its outer section, the wall 62 of the center cup section 61, adjacent to a cavity wherein the roller bearing 55b is seated. Which thrust bearing 70 body 71 other flat side is in contact with roller bearing 55c that is seated in the gear spline sleeve 42 end wherein the thick ring 56 is



fitted. So arranged, as shown in FIGS. 4 and 5, the thrust bearing 70 includes the thin disk shaped body 71 having center opening 72 therethrough and, in practice, is preferably formed as a sandwich of like front and rear plates 73a and 73b, that are maintained in spaced relationship by both an outer ring 74 and an inner ring where through the center opening 72 is formed, and which front and rear plates each include radial slots 75. The radial slots 75 are aligned, with each set of aligned slots providing an opening thereacross wherein is journaled a needle bearing 76 that is supported to turn freely therein. So arranged, the described ball bearing clutch 40 provides the described rapid and smooth engagement to transfer torque from a gear or gears splined onto the gear splined sleeve 42 and disengagement, and the thrust bearing 70 minimizes turning friction between the center sleeve 41 gear splined sleeve 42, to efficiently handle axial loads directed therein. While the invention preferably consists of the described hub clutch and thrust bearing arrangement, it should be understood, that the described hub clutch can be used without the thrust bearing 70 within the scope of this disclosure. Also, while the ring steps 63 have been set out herein as a preferred surface for engaging the ball bearings 59 as have traveled outwardly along the sloping track 58a, as described above, other surfaces, such as a scored surface, one with spaced lateral bars or depressions thereacross, or the like, can be so used, within the scope of this disclosure, as illustrated in FIGS. 8A, 8B, 8C and 8D, and even a smooth surface could be so used as substitute for the described ring steps 63. Therefore, in practice, it should be understood, any appropriate surface can be so used in addition to the ring steps 63 to provide a surface whereto the ball bearing 59 surface will engage, and bind against, to lock the respective gear splined sleeve 42 and center sleeve 41 together for transferring torque transmitted into the gear splined sleeve 42.

As shown best in FIGS. 4 and 5, the hub 40 additionally includes a gear splined sleeve spacer 81 that is fitted over axle 45 and is held in place by lock ring 82a, provides for holding bearing 55d in place, and the center sleeve is shown as including a pair of spacers 83a and 83b that are fitted over axle 45 and includes a lock ring 82b fitted thereto to urge the spacers into the center sleeve end, adjacent to the flange 43b. End caps 46a and 46b are shown turned over the axle 45 threaded ends 45a and 45b, for holding the components together, completing the hub 40 assembly.

The hub 40, as set out above, is suitable for inclusion with a geared or direct drive bicycle, or the like, and a geared bicycle 85 is shown in FIG. 7 as an example of such bicycle. The bicycle 85, as shown, includes a peddle arrangement 86 that is turned to move a chain 87 across one of a stack of gears 88 as are spline fitted over hub 40, turning bicycle wheel 89. Though, it should be understood, another bicycle configuration, other vehicle or machine that is driven as by turning of a peddle arrangement, or the like, could include the hub 40 of the invention, within the scope of this disclosure.

Hereinabove has been set out a description of wheel hub that includes a clutch of the invention that is useful on any vehicle or assembly where a torque is transferred through the hub clutch to turn a wheel, or the like. It should, however, be understood that the present invention can be varied within the scope of this disclosure without departing from the subject matter coming within the scope of the following claims, and a reasonable equivalency thereof, which claims we regard as our invention.

## CLAIMS

We claim:

1. A hub with clutch comprising, a hub body including a first sleeve that includes a means for mounting a driven gear thereon, and a second sleeve that includes means for  
5 arrangement as a wheel hub; a hub clutch arranged between said first and second sleeves including of a ring section fitted onto an end of said first sleeve and includes identical spaced pockets formed at equal spaced intervals around and into said ring section outer surface, with each said pocket including a deep forward section formed to accommodate a ball bearing fitted therein and each said pocket includes an outwardly sloping surface extending from said forward  
10 section to, or near to, said ring section surface, and an end of said second sleeve includes an annular ring section that is adjacent to a cavity wherein said ring section is fitted such that, when said hub is assembled, said spaced pockets oppose an outer surface of said annular ring section, and including ball bearings contained in said pockets to roll from said pocket along said pocket outwardly sloping surface to engage and bind against said annular ring section surface, and with  
15 said first and second sleeves including center passages that align to receive bearings for fitting therein that receive an axle fitted through center openings of said bearings; and a straight axle for fitting through said bearings center openings and including coupling means for fitting onto ends of said straight axle for mounting to a frame.

2. The hub with clutch as recited in claim 1, further including a thrust bearing for  
20 installation on the axle between the first and second sleeves that has a disk shaped body that is open through its center to receive said axle, which said body is formed from a pair of like flat disks that each have spaced radial slots formed therein that are aligned to receive needle bearings journaled therein, and including means for maintaining said pair of like flat disks together.

3. The hub with clutch as recited in claim 2, wherein the thrust bearing is fitted into a cavity formed in the ring section around the center passage formed therethrough, and is sandwiched between the bearings that are fitted, respectively, in the first and second sleeve abutting ends.

5           4. The hub with clutch as recited in claim 1, wherein the spaced pockets are identical and each has a cup shape, with said pocket opening to an upwardly sloping surface that extends oppositely to the direction of the ring section when the wheel is rolling forward; and the annular ring section outer surface includes steps formed at spaced intervals therearound for capturing a ball bearing surface as has traveled along the pocket outwardly sloping surface.

10           5. The hub with clutch as recited in claim 1, further including bearings formed to receive the axle fitted therethrough that each include an outer race of a diameter to fit in cavities formed in the first and second sleeves ends.

6. The hub with clutch as recited in claim 1, wherein the first sleeve includes as the means for mounting a driven gear thereon, a plurality of spaced raised longitudinal sections  
15   formed around the first sleeve exterior surface that receive a center opening of each gear to allow each said gear to slide over said spaced raised sections and lock thereon.

7. A hub with clutch comprising, a hub body including a first sleeve that includes a means for mounting a driven gear thereon, and a second sleeve that includes means for arrangement as a wheel hub; a hub clutch arranged between said first and second sleeves  
20   including of a ring section fitted onto an end of said first sleeve and includes identical spaced pockets formed at equal intervals around and into said ring section outer surface, with each said pocket including a forward section formed to have a size and shape to accommodate a ball bearing fitted therein and each said pocket includes an outwardly sloping trough type surface

extending from said forward section to, or near to, said ring section surface, and an end of said second sleeve includes an annular ring section located adjacent to a cavity wherein said ring section is fitted such that, when said hub is assembled, said spaced pockets oppose an outer surface of said annular ring section that includes means for providing a friction surface thereto  
5 whereby ball bearings contained in said pockets can roll along said pocket outwardly sloping trough type surface to engage said annular ring section friction surface, and said first and second sleeves include center passages that align to receive bearings fitted therein that receive an axle fitted through center openings that are formed through said bearings; and a straight axle for fitting through said bearings center openings and including coupling means for fitting onto ends  
10 of said straight axle for mounting to a frame.

8. The hub with clutch as recited in claim 7, further including a thrust bearing for installation on the axle between the first and second sleeves that has a disk shaped body that is open through its center to receive said axle, which said body is formed from a pair of like flat disks that each have spaced radial slots formed therein that are aligned to receive needle bearings  
15 journaled therein, and including means for maintaining said pair of like flat disks together.

9. The hub with clutch as recited in claim 8, wherein the thrust bearing is fitted into a cavity formed in the ring section around the center passage formed therethrough, and is sandwiched between the bearings that are fitted, respectively in the first and second sleeve abutting ends.

20 10. The hub with clutch as recited in claim 7, wherein the spaced pockets are identical and each has a cup shape, with said pocket opening to and upwardly sloping surface that extends oppositely to the direction of the ring section turning when the wheel is rolling forward; and the annular ring section other surface includes steps formed at spaced interval therearound as the

friction surface for capturing a ball bearing surface as has traveled along the pocket outwardly sloping surface.

11. The hub with clutch as recited in claim 7, further including bearings formed to receive the axle fitted therethrough that each include an outer race of a diameter to fit in cavities  
5 formed in the first and second sleeves ends.

12. The hub with clutch as recited in claim 7, wherein the first sleeve includes a plurality of spaced raised sections formed as spaced longitudinal sections formed around the first sleeve exterior surface that are to receive one or more gears, each having a center opening to slide over said spaced raised sections, each said gear and lock thereon.

10 13. A hub with clutch comprising, a hub including a first sleeve that includes a means for mounting a driven gear thereon, and a second sleeve that includes means for arrangement as a wheel hub; a hub clutch arranged between said first and second sleeves including a ring section fitted onto an end of said first sleeve and includes identical spaced pockets formed at equal spaced intervals around and into said ring section outer surface, with each said pocket including  
15 a deep forward section formed to accommodate a ball bearing fitted therein and each said pocket includes an outwardly sloping surface extending from said forward section to, or near to, said ring section surface, and an end of said second sleeve includes an annular ring section adjacent to a cavity wherein said ring section is fitted such that, when said hub is assembled, said spaced pockets oppose an outer surface of said annular ring section whereby ball bearings contained in  
20 said pockets can roll along said pocket outwardly sloping surface and engage, to bind against, said annular ring section surface, and said first and second sleeves include center passages that align to receive bearings fitted therein that receive an axle fitted through center openings of said bearings; a bearing means fitted between said first and second sleeves for minimizing load forces



directed across said first and second sleeves; and a straight axle for fitting through said bearings center openings and includes coupling means for fitting onto ends of said straight axle for mounting to a frame.

14. The hub with clutch as recited in claim 13, wherein the bearing means fitted between  
5 the first and second sleeves is a thrust bearing for installation on the axle between said first and second sleeves that has a disk shaped body that is open through its center to receive said axle, which said body is formed from a pair of like flat disks that each have spaced radial slots formed therein that are aligned to receive needle bearings journaled therein, and including means for maintaining said pair of like flat disks together.

10 15. The hub with clutch as recited in claim 14, wherein the thrust bearing is fitted into a cavity formed in the ring section around the center passage formed therethrough, and is sandwiched between the bearings that are fitted, respectively, in the first and second sleeve abutting ends.

16. The hub with clutch as recited in claim 13, wherein the spaced pockets are identical  
15 and each has a cup shape, with said pocket opening to an upwardly sloping surface that extends oppositely to the direction of the ring section when the wheel is rolling forward; and the annular ring section outer surface includes steps formed at spaced intervals therearound for capturing the surface of a ball bearing as has traveled along the pocket outwardly sloping surface.

17. The hub with clutch as recited in claim 13, further including bearings formed to  
20 receive the axle fitted therethrough that each include an outer race of a diameter to fit in cavities formed in the first and second sleeves ends.

18. The hub with clutch as recited in claim 13, wherein the first sleeve includes, as the means for mounting a driven gear thereon, a plurality of spaced raised sections formed as

longitudinal sections formed around the first sleeve exterior surface that are to receive a center opening formed through a gear or gears that are to slide over said spaced raised sections and lock thereon.



## ABSTRACT

A wheel hub with clutch where power is transferred through a drive, such as a chain that is linked between a peddle arrangement and a gear or gears splined onto the hub. The hub provides free-wheeling when torque is not applied thereto and will  
5 instantly engage, transferring an applied torque therethrough and into a wheel connected to the hub when torque is applied as through a peddle arrangement. For locking, the hub includes, as a radial load bearing component, a sleeve whereon a gear or gears are splined, with the splined gear sleeve mounting a thick ring for fitting into an end of a wheel sleeve. The thick ring contains spaced sloping pockets, each containing a ball  
10 bearing. The wheel sleeve includes an annular ring that receives the thick ring fitted there and has spaced steps, or the like, formed therein to engage the ball bearing surfaces, transferring torque.

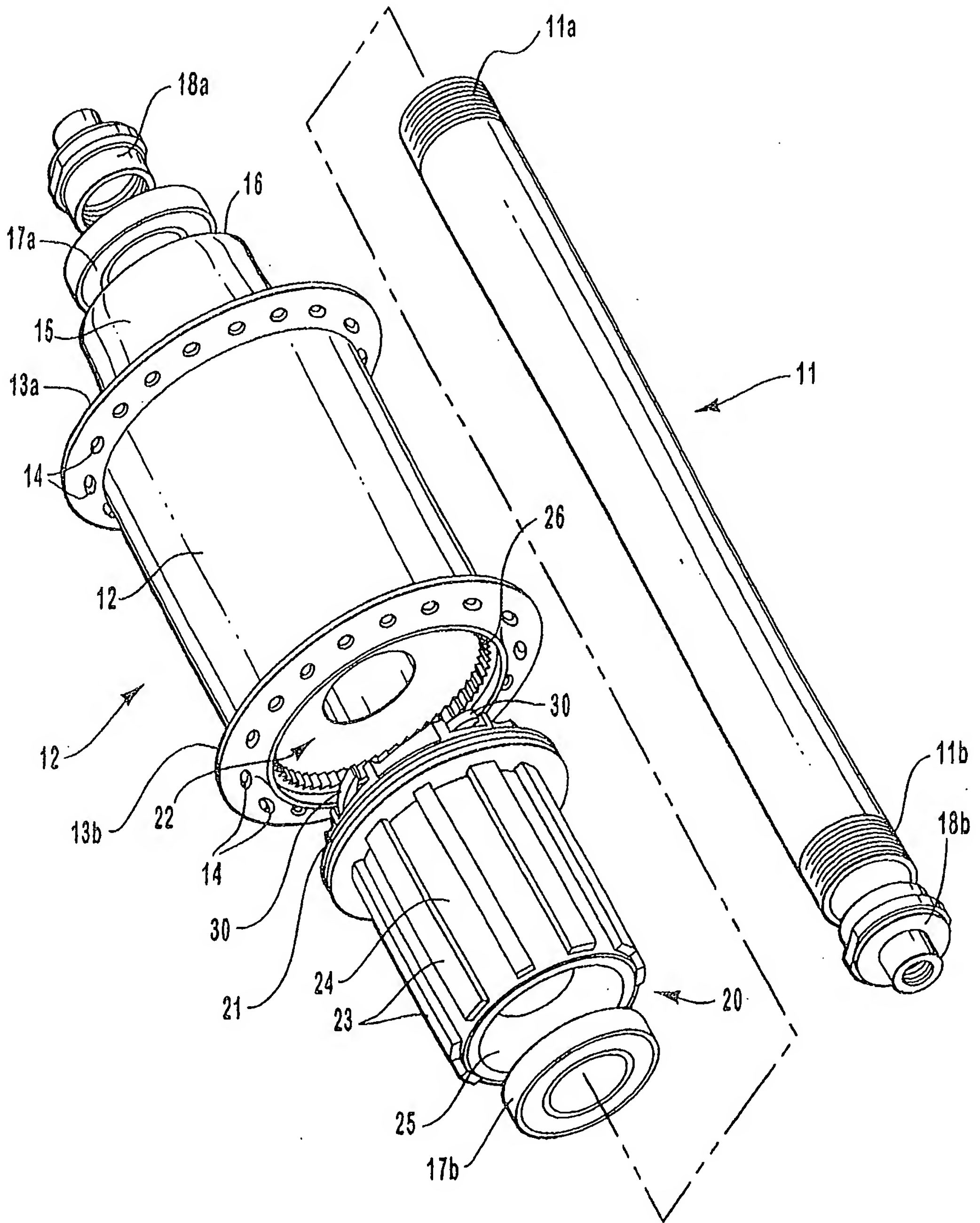


FIG. 1  
(PRIOR ART)

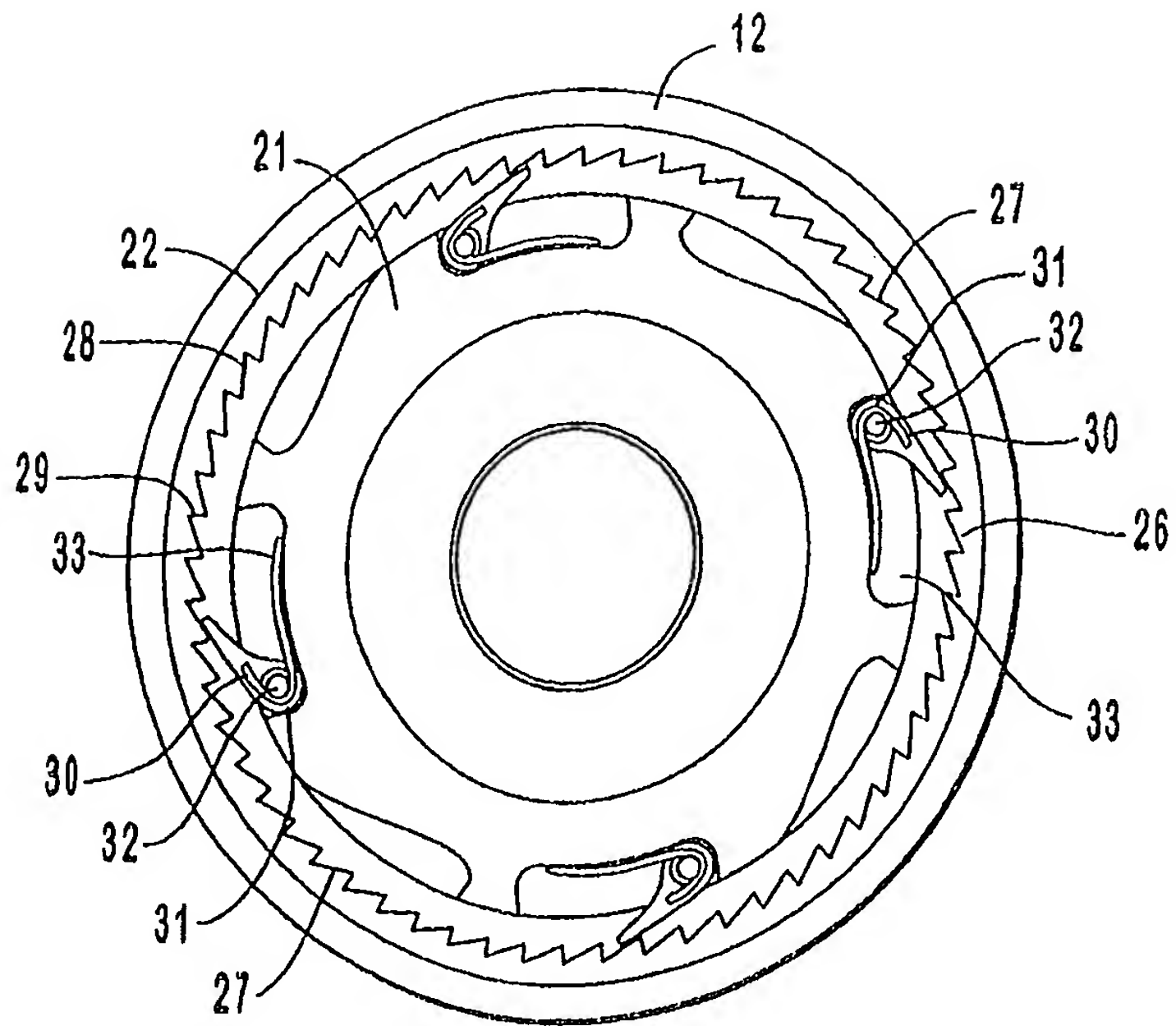


FIG. 2A  
(PRIOR ART)

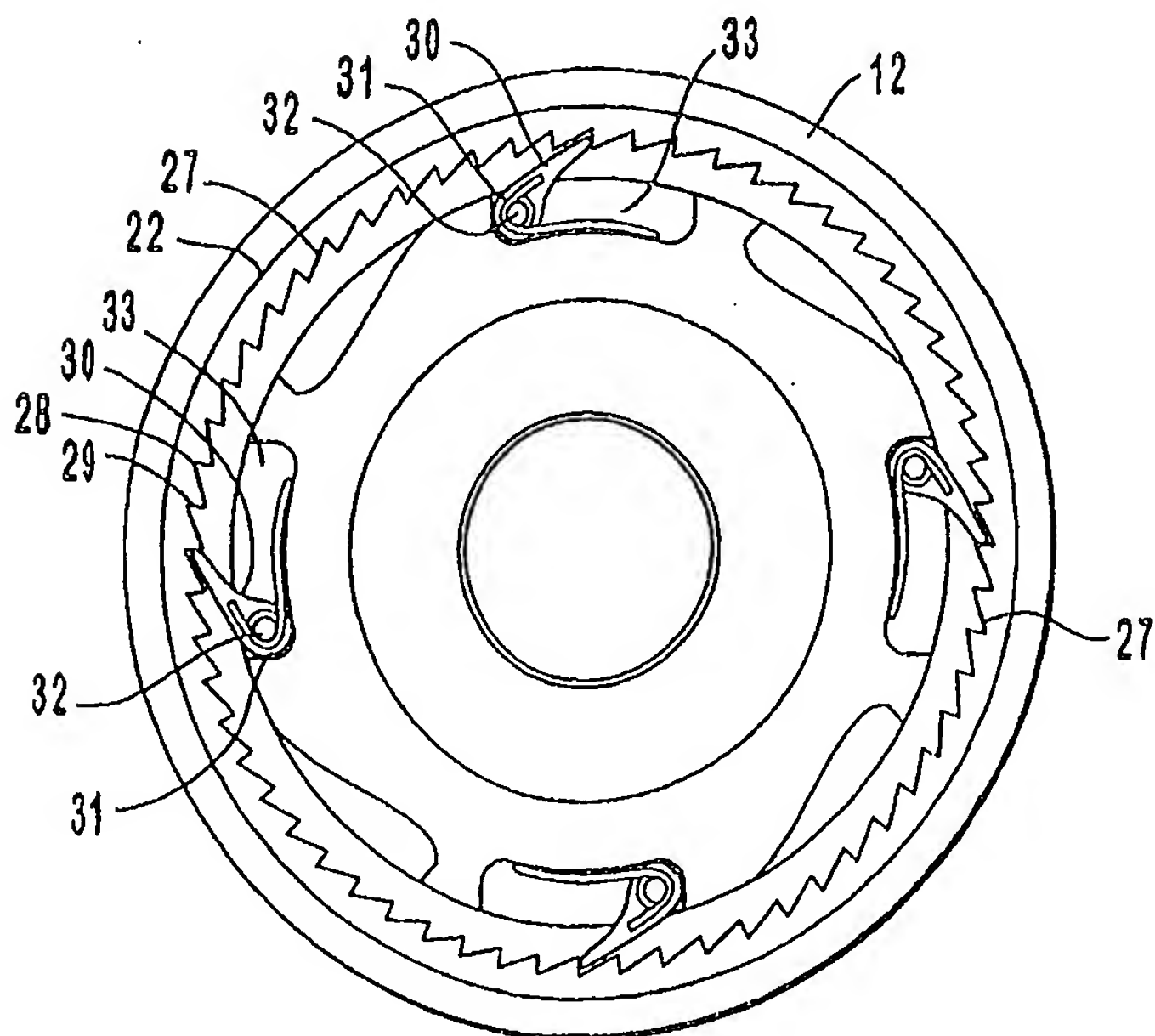


FIG. 2B  
(PRIOR ART)

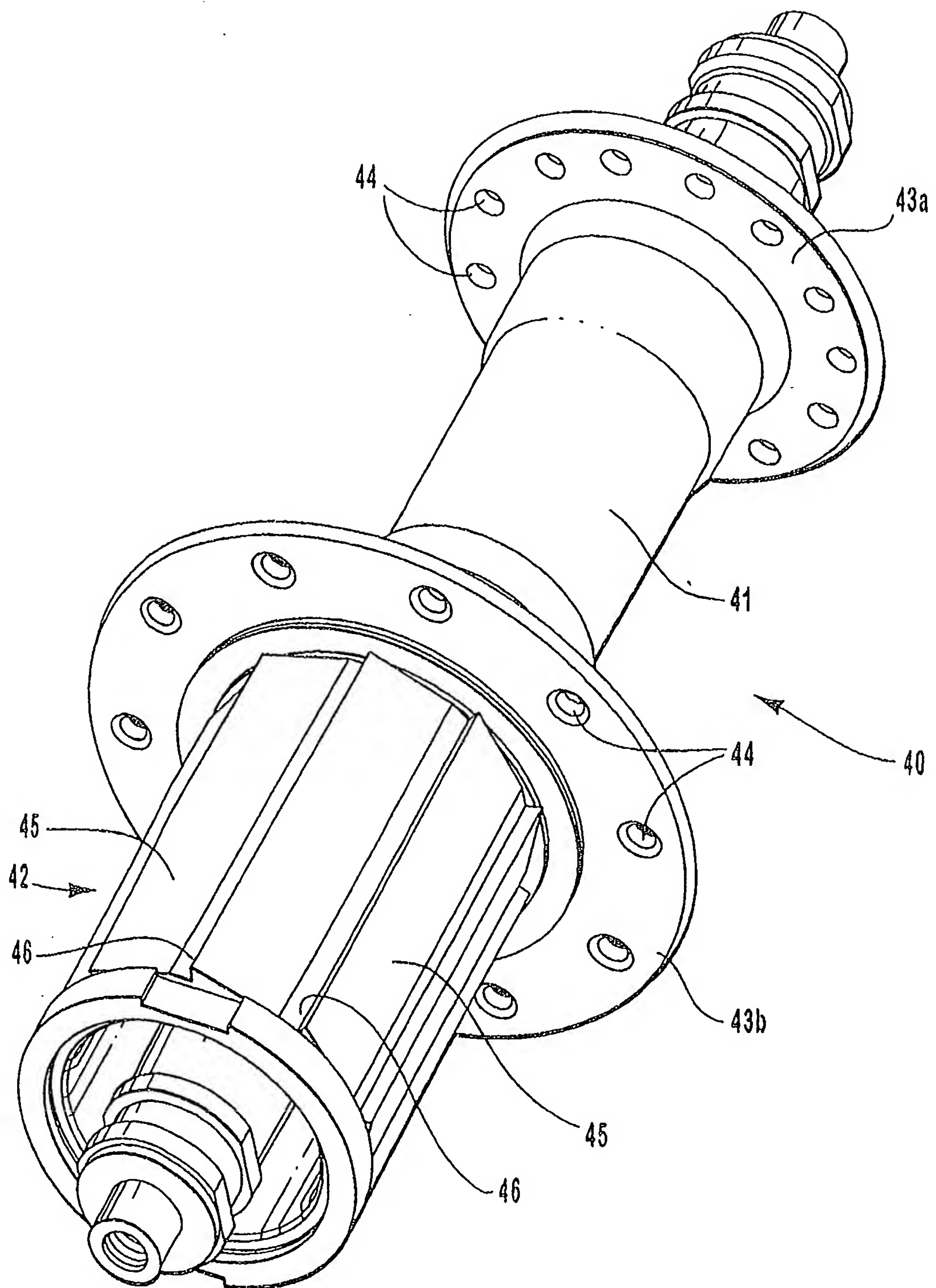


FIG. 3

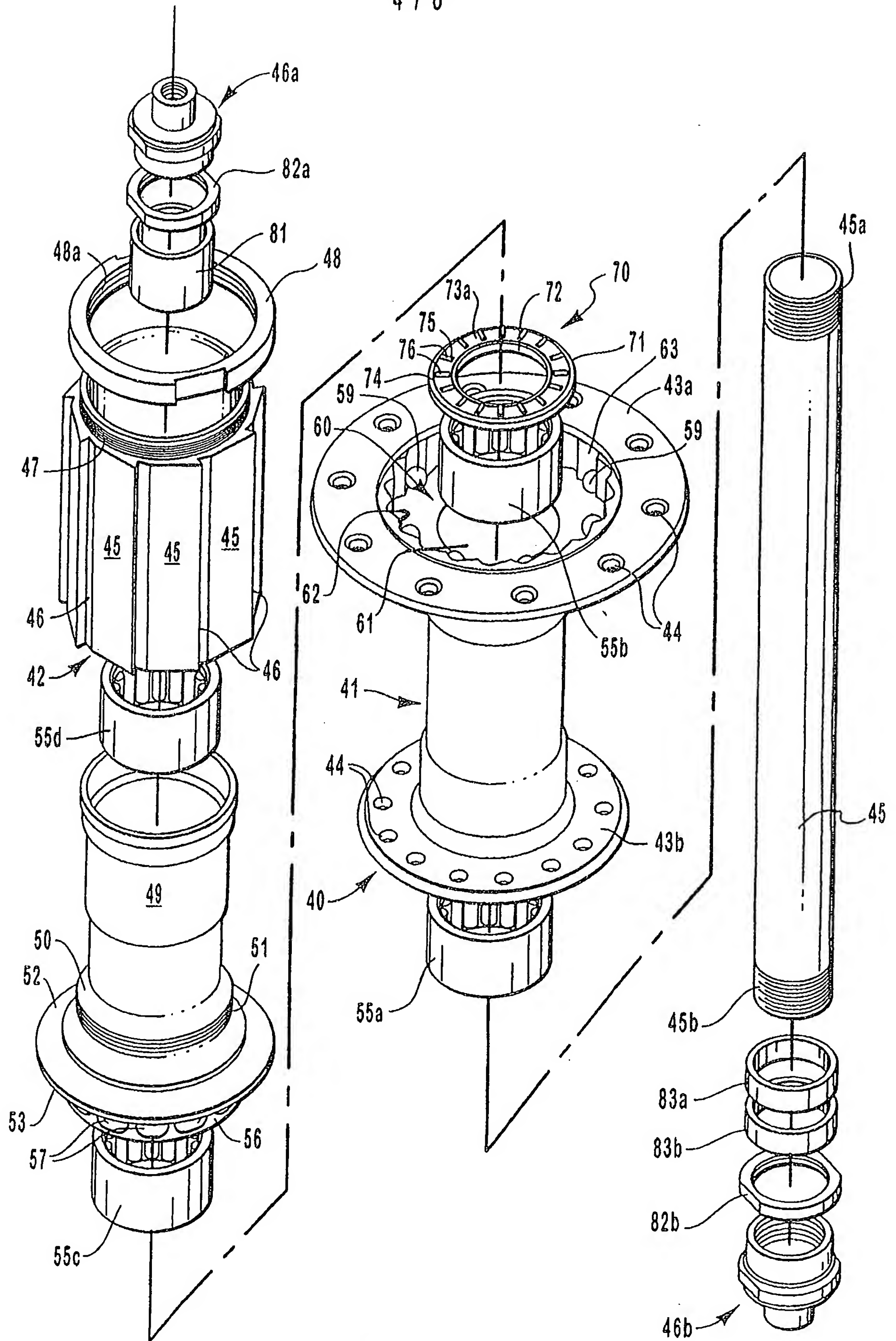


FIG. 4





6 / 8

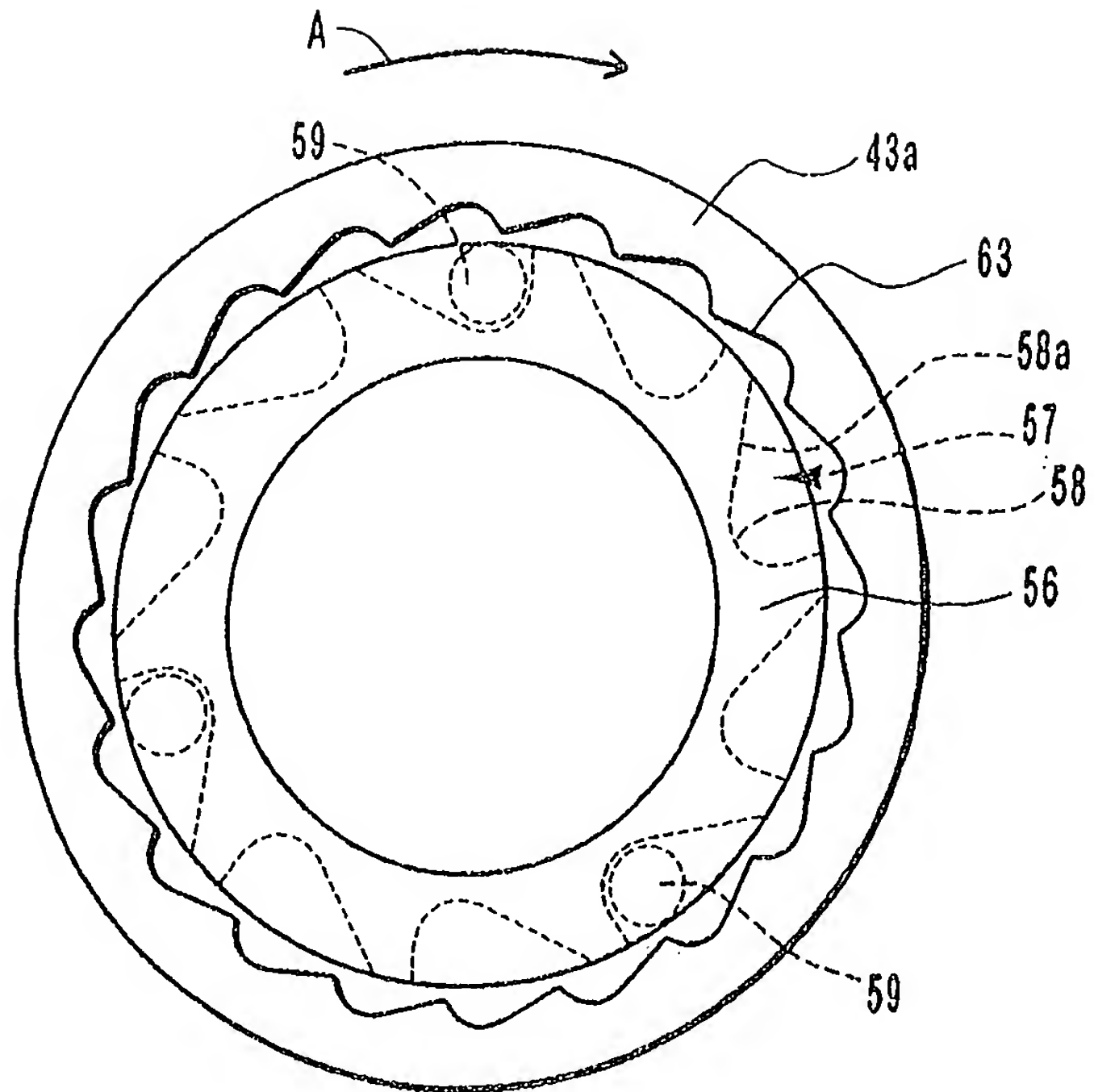


FIG. 6A

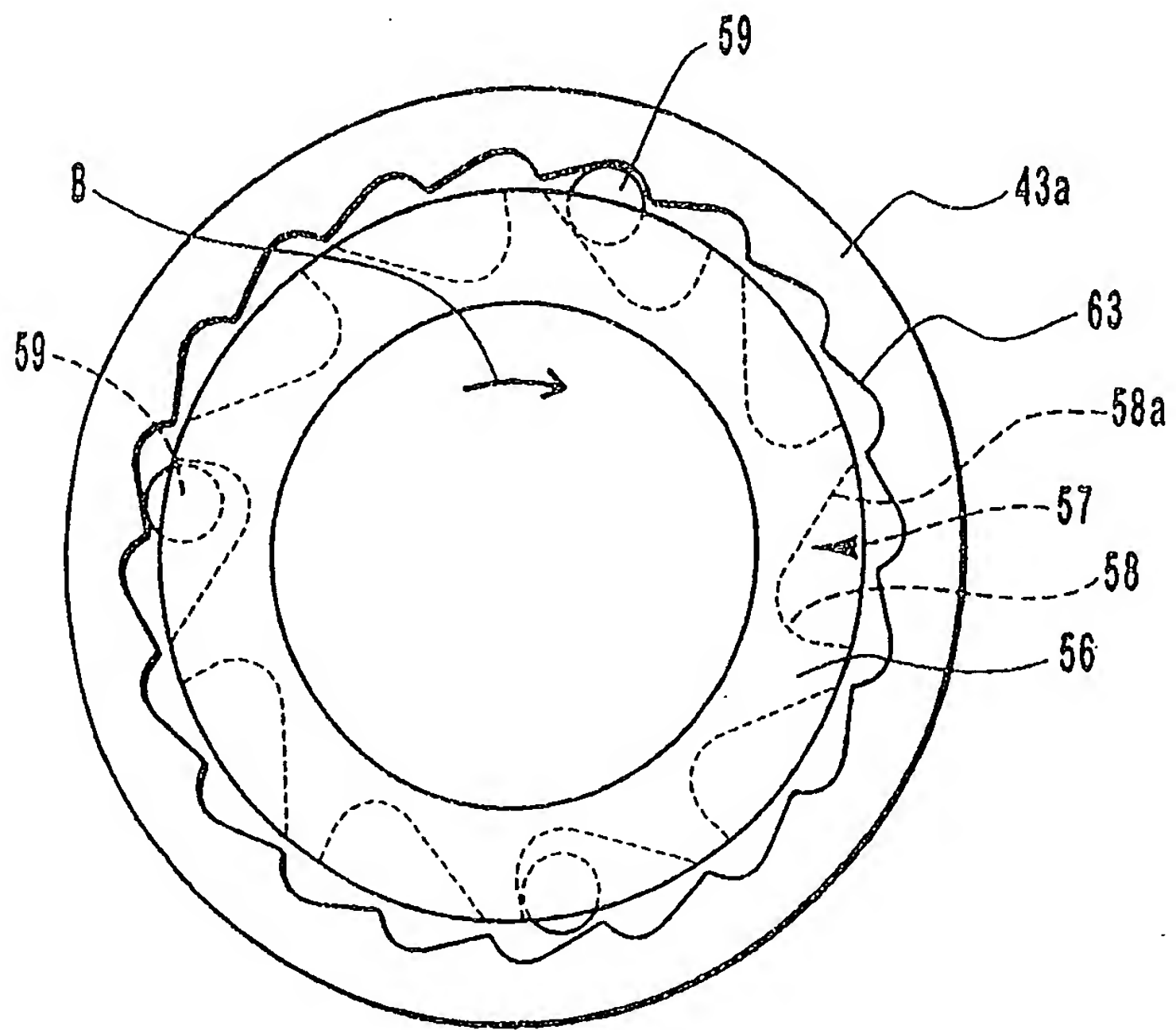


FIG. 6B

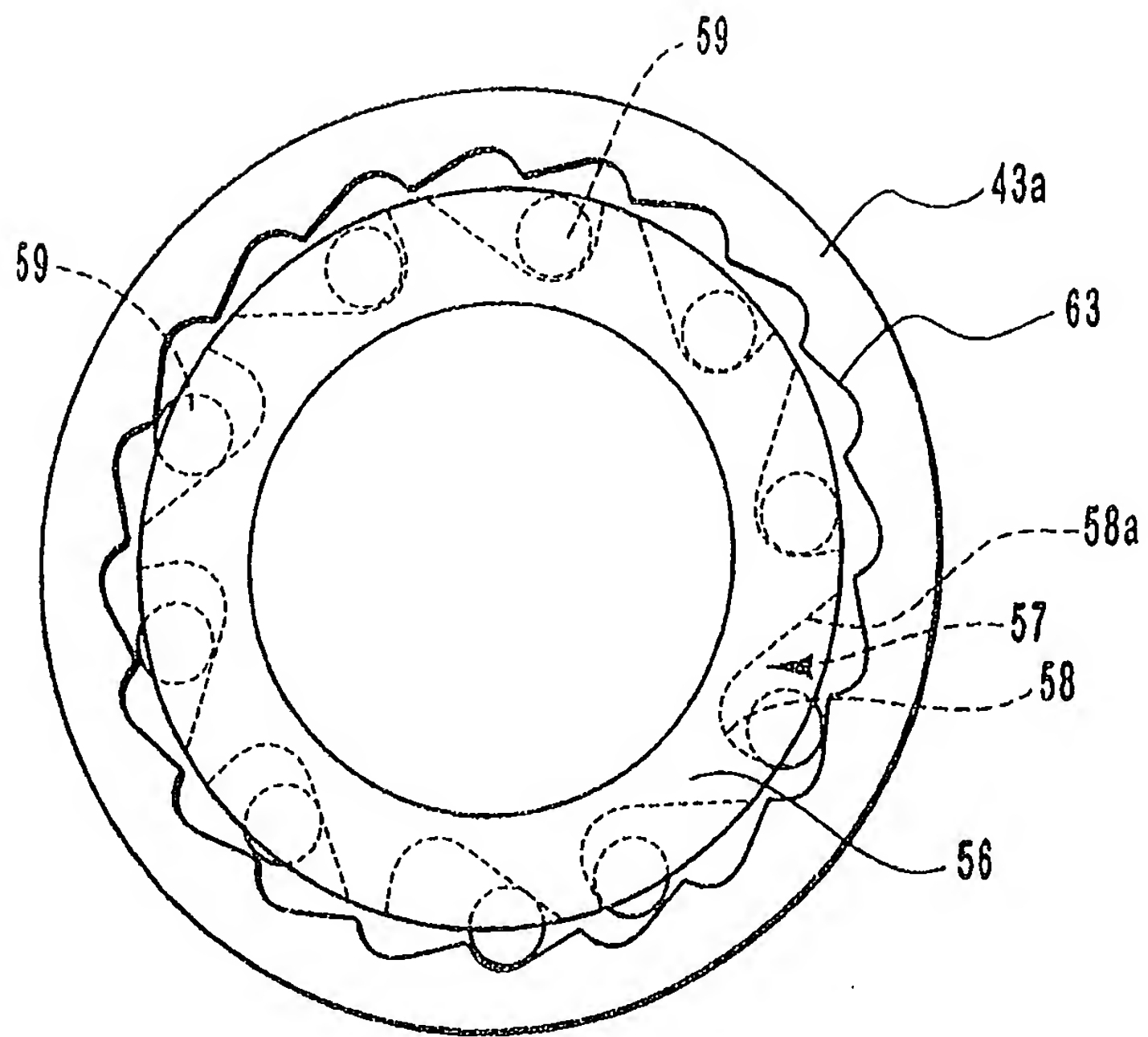


FIG. 6C

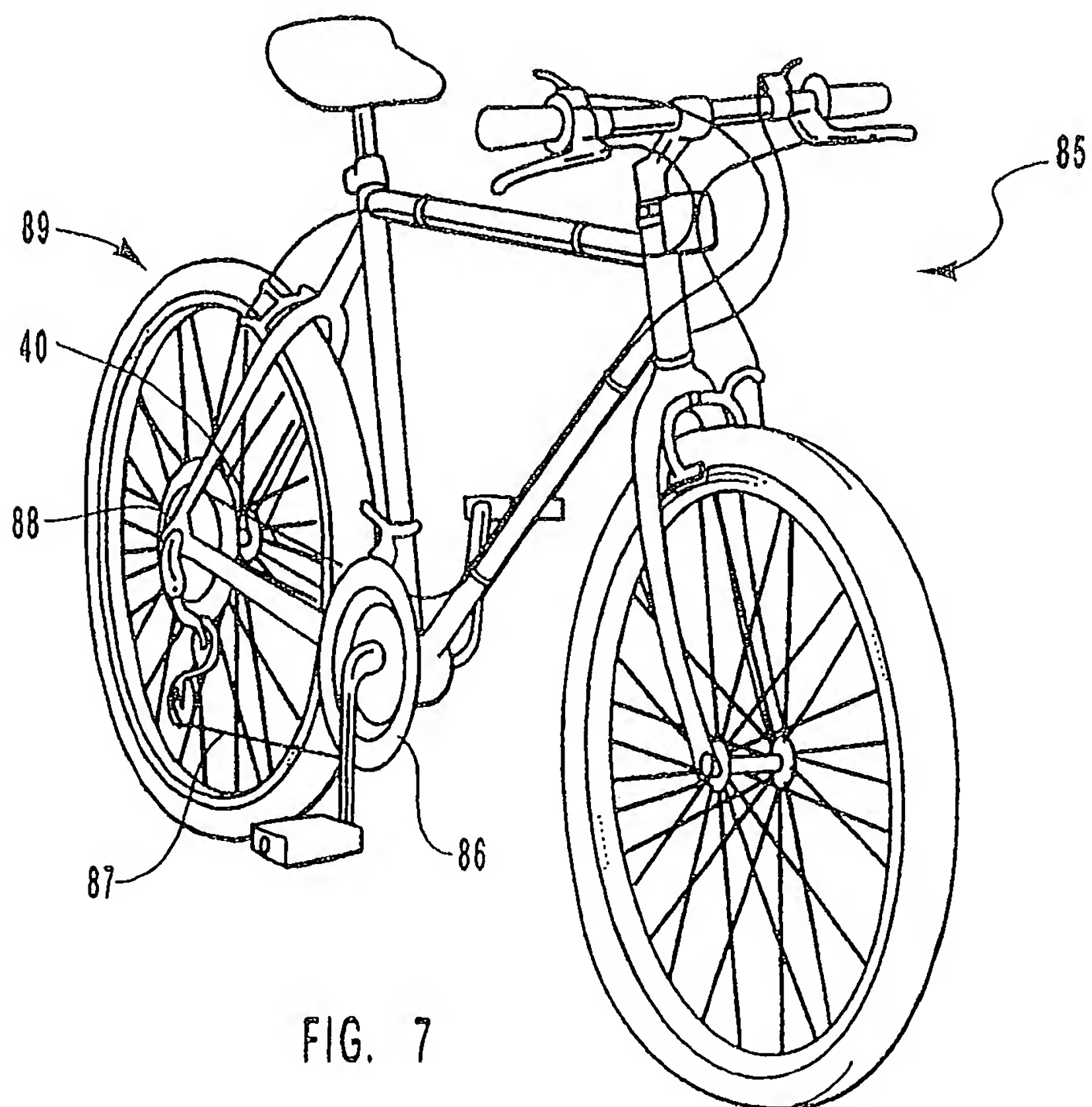


FIG. 7

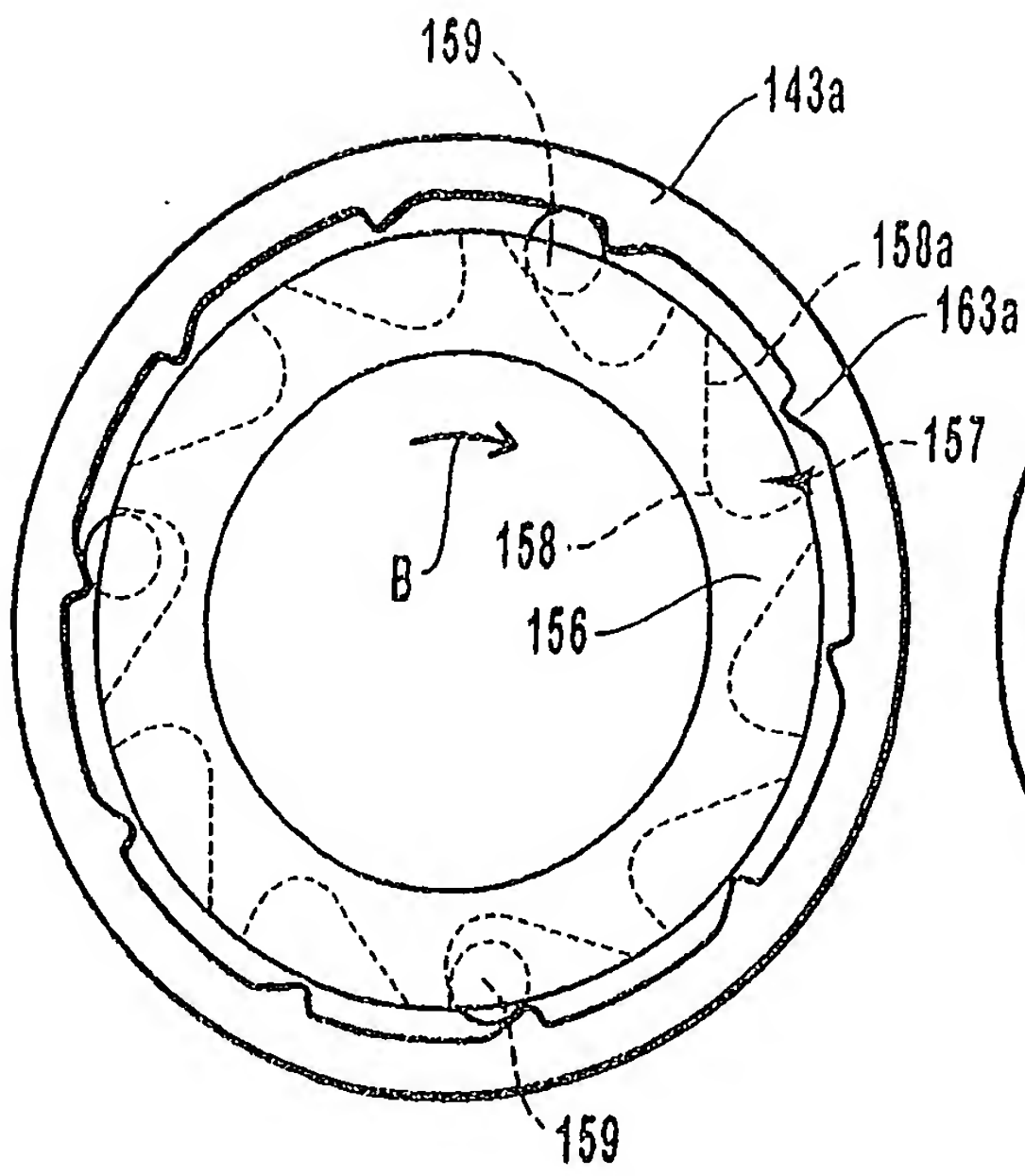


FIG. 8A

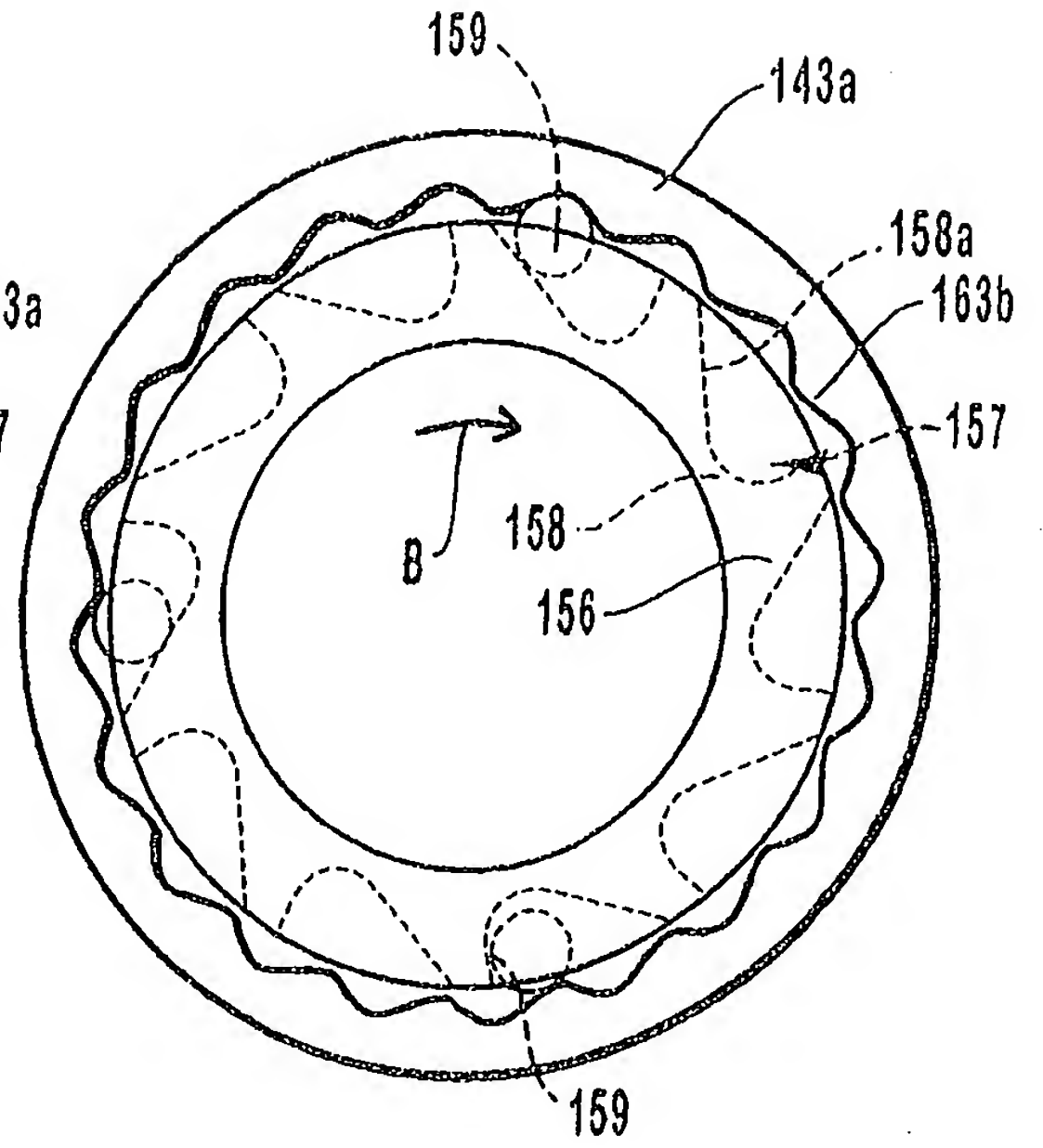


FIG. 8B

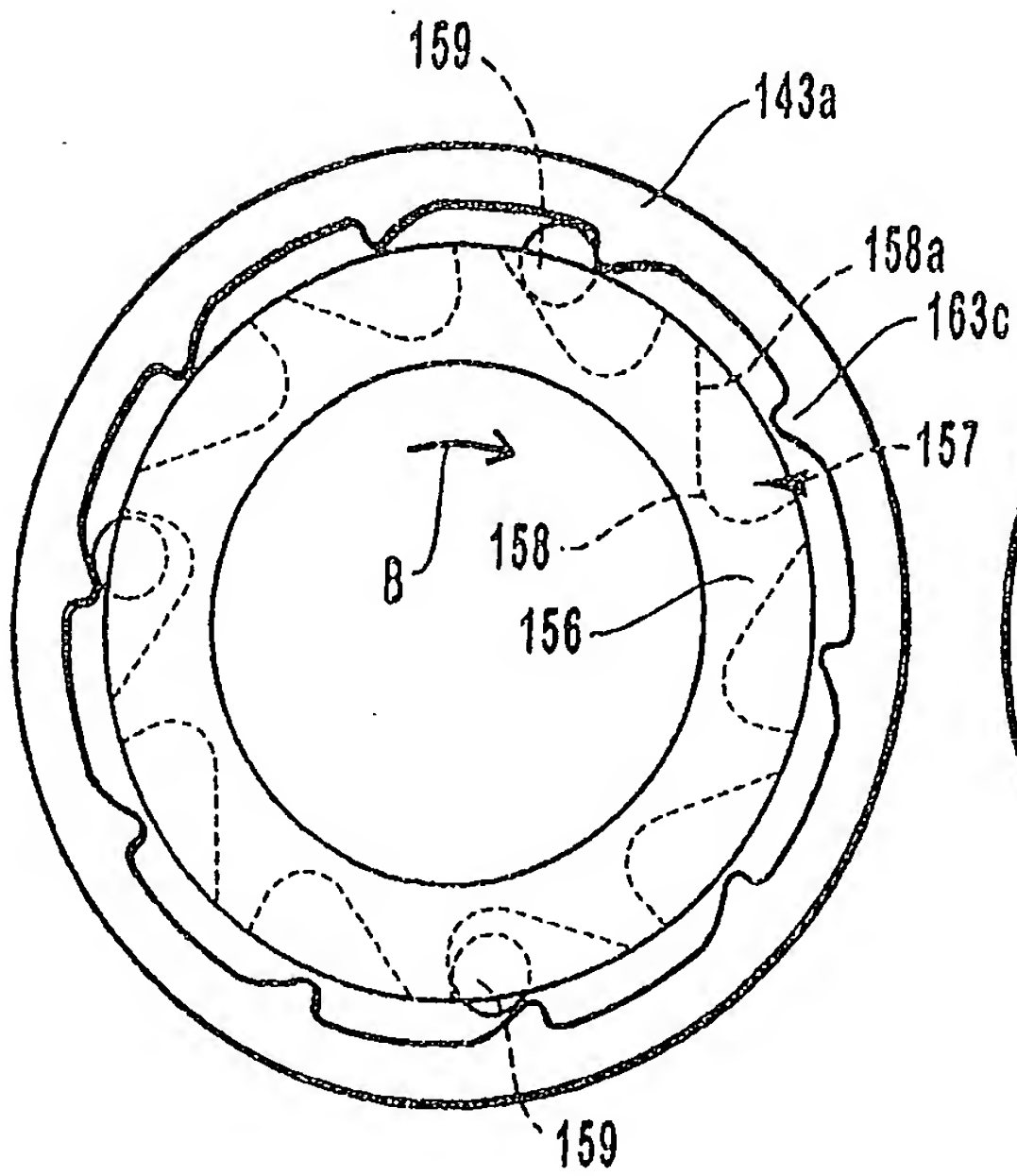


FIG. 8C

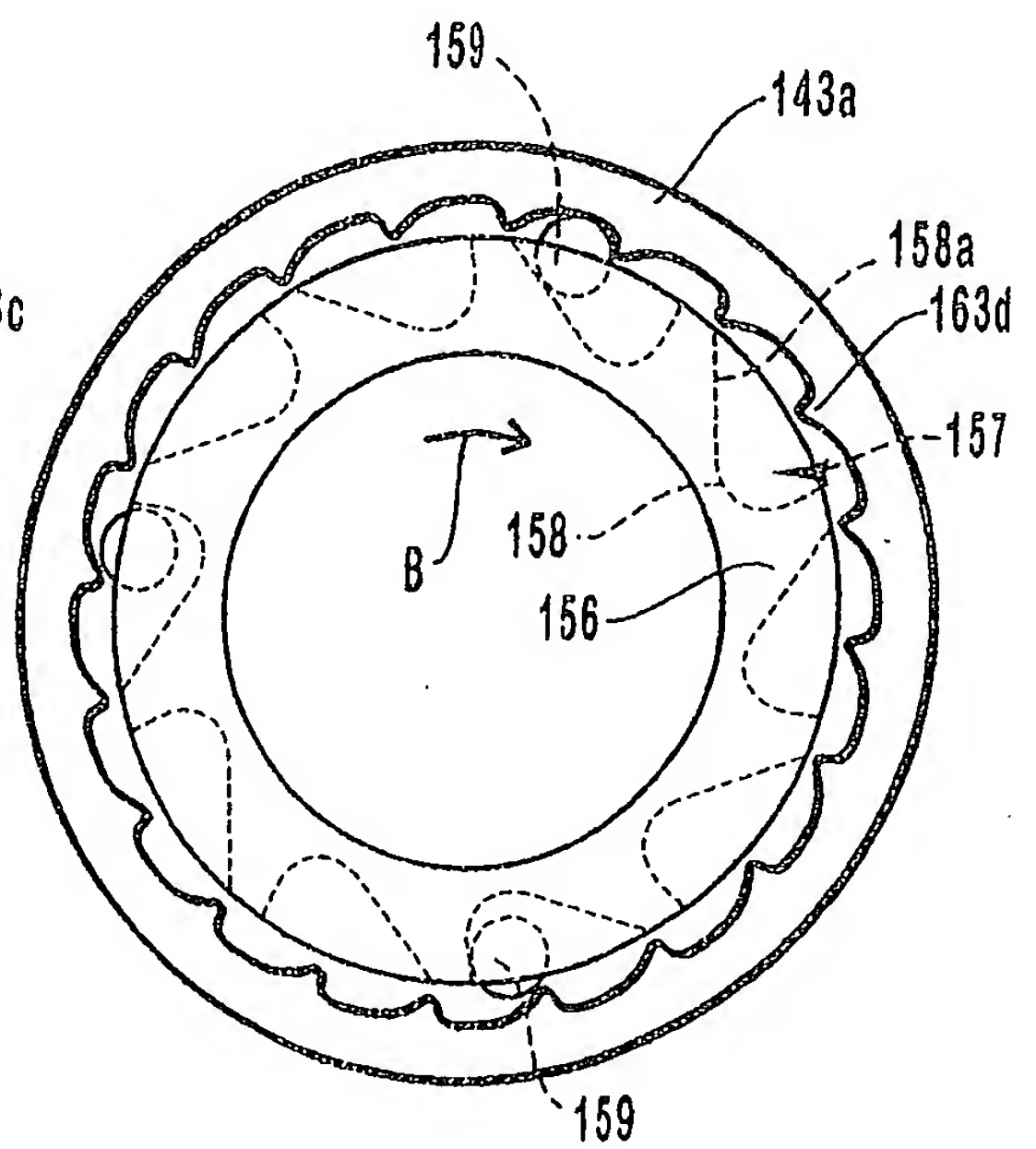


FIG. 8D

## SPECIFICATION

### BACKGROUND OF THE INVENTION

#### Field of the Invention

The present invention relates to wheel hubs and primarily bicycle type wheel hubs with clutches where the hub is free wheeling when torque is not being applied to the hub through a gear that is linked by a chain to a peddle arrangement, and will engage to transfer torque to a hub wheel when torque is applied to the peddle assembly.

#### Prior Art

Wheel hubs having clutches capable of free wheeling when a torque is not being applied thereto, as through a chain linked to a peddle arrangement, or like driving arrangement, but will engage to transmit torque to turn a hub wheel as generated by an operator turning such peddle arrangement are, of course, well known, and are in common use. For example, on bicycles that are directly driven through a single gear, or include multi-speed gearing. One such earlier hub design, that is believed to be the basic design of most earlier hubs for use with multi-speed gearing, is shown in Figs. 1, 2A and 2B and is described as prior art in the Detailed Description portion of this application. This earlier hub, unlike the invention, is a ratchet type design that includes an annular ring gear that has its outer circumference secured to the inner wall of a hub body and includes teeth or notches formed around the ring gear inner circumference that slope in the direction of turning of the hub body when it is free wheeling, and includes pawls that are spring biased and are connected to extend outwardly at spaced intervals from around a peddle assembly that each have a tooth end. In free wheeling operations, the outwardly biased pawl tooth ends will each travel up the slope of

each ring gear tooth or annular notch, and with the spring biasing to extend each pawl tooth end to cause the pawl end to travel down the tooth or annular notch face and engage the next tooth or annular notch face. Thereby, when the peddle assembly is turned, that turning will be against the slope of the ring gear teeth or annular notch, and the pawl tooth ends will engage and bind against the ring gear teeth faces or annular notches, transmitting an applied torque through the ring gear and into the wheel hub body to drive the wheel.

The above described spring-actuated ratchet type design for a hub clutch has, since the early nineteen hundreds, been the standard for over-running wheel hub transmissions. In practice, such spring-actuated ratchet type design provides a torque transfer from a peddle assembly, or the like, to turn a wheel at the expense of reliability and durability and accordingly necessitates high-maintenance costs. This is because the hub clutch components, specifically the pawls and their springs, are exposed to high cyclical fatigue and are therefore failure prone. Such failure is characterized by cracked pawls, or broken or bent springs. Typically, in the event of a failure of only one of the springs or pawls, a typical lightweight, high performance wheel hub will suffer a rapid deterioration of the remaining spring pawl components, resulting in total hub failure.

Additionally, earlier systems as have employed ball bearing assemblies for power transfer through a hub to turn a wheel have not included a series of spaced pockets that each incorporates a sloping side configuration like that of the invention and have required that each ball bearing carry both a radial load, that is applied perpendicular to the bearing assembly, and axial loads as are transmitted through the axle. In such earlier systems, higher friction forces have resulted from a scrubbing of the bearing surface as occurs at the portion of the ball bearing that carries radial loads with the bearing portion as supports radial loads tending to rotate faster than the ball bearing portion



that is carrying thrust loads. In the invention, radial loads are contained and carried at an annular race and seat portion wherein the spaced sloping pockets of the hub assembly are formed, and the hub assembly preferably includes a separate axle thrust bearing or bearings that incorporate radially spaced needle bearings to support axial loads.

Unlike earlier wheel hub designs, the hub of the invention will not deteriorate when exposed to cyclical fatigue, in that it does not include the vulnerable and unreliable spring biased pawls, but rather employs a unique combination of hub body race arrangement that is formed as spaced sloping pockets and opposing annular ring that includes spaced cup or step segments with ball bearings installed into which opposing sloping pockets and cup or step segments, providing immediate engagement upon receipt of a torque or turning force.

#### SUMMARY OF THE INVENTION

The invention is in a wheel hub constructed to provide low rolling resistance, greater load carrying capacity with enhanced torque transmission, that is more reliable and will therefore operate reliably at less cost. The hub is free-rolling, providing over-running in a clock-wise or forward turning direction, but provides a nearly instantaneous clutch locking when a peddle or like drive force is applied thereto, as through a chain. So arranged, nearly instantaneous torque transfer is provided through the hub, as when the hub of the invention is in use with a bicycle driven wheel. The hub of the invention facilitates torque transfer through a multitude of ball bearings that are each housed in contoured pockets that interface with an opposing face of an annular ring of the hub body whereto a wheel is supported through spokes, ribs, or the like. The clutch bearing system of the invention is to carry a radial load that is the load that results perpendicular to the hub as from a road surface, with the applied loads transferred through a coupling of the hub outer and annular sections.

For the wheel hub clutch of the invention, the hub outer section pockets slope rearwardly from a greater to lesser height in a direction that is counter to the direction of the applied torque. Thereby, when torque is applied in the direction of hub free-wheeling, ball bearings maintained in the hub pockets will each instantly travel opposite to the applied torque, and travel upwardly along the pocket slopes towards the pockets lesser height sections, traveling upwardly along the pocket slope to bind against the ring steps. In clutch operation, the hub interior and exterior sections are thereby connected at multiple points therearound, equally distributing the applied torque through as many as ten ball bearings.

For carrying axial loads that are parallel to the road surface and are transmitted through the axle, the invention can include at least one thrust bearing fitted between the hub interior and exterior sections that includes a pair of like disk shaped plates that are fitted together and have radially spaced cylindrical openings that align as pairs to each receive a needle bearing journaled therein. In the invention, applied radial and axial loads are supported by the combination of ball and needle bearings that operate in conjunction with standard roller bearings as are fitted between a stationary axle and support the hub whereto a rim is mounted, as through spokes, or like arrangement.

It is a principal object of the present invention to provide a hub clutch bearing assembly that provides for a nearly instantaneous coupling of hub inner and annular sections across ball bearings for transferring torque from the hub inner section to the outer section whereto a wheel rim is secured.

Another object of the present invention is to provide a wheel hub clutch consisting of inner and outer hub sections, with the inner section for mounting to an axle that is turned by a peddle arrangement to transfer torque thereto, and with the inner section including a ring having spaced contoured pockets formed therearound that are each fitted with a ball bearing, and with the hub outer

section including an annular ring having spaced steps sections, and with each ball bearing to nest and bind between a pocket surface and a ring step, transferring torque thereacross.

Another object of the present invention is to provide the inner ring with contoured pockets that slope upwardly from a deep section in the direction of wheel turning, whereby each ball bearing, at peddle turning, will roll oppositely to the direction of peddle turning, traveling upwardly along the pocket contour and into engagement with an adjacent ring step, causing the ball bearing to bind therebetween, transferring torque from turning the peddle arrangement into the turning hub outer section.

Another object of the present invention is to provide a wheel hub that will present a minimum rolling resistance in a free-wheeling mode and includes a clutch that will nearly instantly and positively connect to transmit torque when a peddle arrangement is turned, and will quickly disengage when a peddle turning force is removed.

Another object of the present invention is to provide a wheel hub clutch where engagement of hub inner and outer sections is through a plurality of ball bearing where the ball bearings each turn between engagements and thereby preclude scuffing of the ball surface over time and repeated couplings.

Still another object of the present invention is to provide a wheel hub where hub inner and outer section coupling is through ball bearings for supporting road forces as are directed perpendicularly into the hub, with the hub further including at least one thrust bearing fitted between the hub sections for supporting side or axial loads.

Still another object of the present invention is to provide a thrust bearing that consists of needle bearings that are mounted radially in a disk shaped body that is open through its center to

receive an axle fitted therethrough, with the thrust bearings to support side or axial loads as are directed into the hub.

Still another object of the present invention is to provide a wheel hub clutch that is simple and economical to manufacture and will provide a sure and nearly instantaneous engagement to transfer torque, as from a turning peddle arrangement, to turn a wheel whereto the hub is mounted

### **BRIEF DESCRIPTION OF THE DRAWINGS**

These and other objects and features of the present invention will become more apparent from the following description in which the invention is described in detail in conjunction with the accompanying drawings:

Fig. 1 is a side and end elevation exploded perspective view of a hub and axle that is identified as Prior Art;

Fig. 2A is an end sectional view of the assembled hub of Fig. 1 taken across a hub coupling end showing spring biased pawls ratcheting over teeth apexes of a hub outer portion annular ring section when the hub is free-wheeling, and the peddle assembly is not being turned to produce a drive torque;

Fig. 2B is a view like that of Fig. 2A showing the pawls in engagement with the sides of the annular ring teeth when the peddle assembly is turned by an operator, producing a drive torque;

Fig. 3 is a side elevation perspective view of a hub of the invention shown arranged as a bicycle hub that includes spoke holes that are for securing spoke ends therein;

Fig. 4 is a side elevation exploded perspective view of the hub of Fig. 3;

Fig. 5 is a longitudinal sectional view of the hub of Fig. 3, shown as having been assembled and whereto spokes have been attached to form a wheel, such as a bicycle wheel, showing the hub

axle supported to the hub between pairs of conventional roller bearing and showing the hub clutch as including inner and outer annular sections, with roller bearings fitted in contoured pockets or the hub inner section and to engage adjacent to stepped portions of an annular ring of the hub outer section, and showing the hub clutch sections separated by a thrust bearing;

Fig. 6A is an enlarged end sectional view taken along the line 6A - 6A of Fig. 5, showing the assembled clutch load bearing and torque transfer system in a free-wheeling attitude;

Fig. 6B is a view like that of Fig. 6A showing the roller bearings in the hub inner section pockets as having been moved outwardly, responsive to axial turning, and have traveled along the pocket tracks into engagement with the stepped portions of an annular ring of the hub outer section;

Fig. 6C is a view like that of Fig. 6B showing the roller bearings as having fully moved into binding engagement between the hub inner section pockets and the hub outer section stepped portions, transferring an applied torque thereacross;

Fig. 7 shows a front end and side perspective view of a mountain bicycle having a gear operated peddle and chain torque transfer arrangement that the wheel hub of the invention is suitable for installation on; and

Figs. 8A, 8B, 8C and 8D are views like that of Figs. 6A, 6B and 6C only showing alternative arrangements of the hub out section stepped portions.

### **DETAILED DESCRIPTION**

The invention, as is hereinafter described, relates to wheel hubs that remain unengaged or free-wheeling during a coasting mode where, torque is not being applied to turn the wheel in a clockwise direction, and includes a clutch that will immediately engage to transfer torque from a clockwise turning of the hub inner portion or section, for transferring torque across the hub and into

the wheel mounted onto the hub.

Fig. 1 shows an exploded perspective view of a hub 10 and axle 11 that is identified as Prior Art and is here included to illustrate what has been and is currently a market standard of a wheel hub with clutch. Shown in Fig. 1, the hub 10 includes a center sleeve 12 that has up-turned flange ends 13a and 13b that each have spaced holes 14 formed therearound to receive ends of spokes, not shown, fitted thereto to form a wheel, such as a bicycle wheel like the wheel 89 that is shown fitted to a bicycle 85, as shown in Fig. 7. Shown in Fig. 1, the hub center sleeve 12 is stepped inwardly from flange end 13a into a collar 15 having a flat outer end 16 that is open and is itself stepped to receive and seat a roller bearing 17a fitted therein. The roller bearing 17a is open across its center to receive axle 11 that has traveled through the center sleeve 12 and is fitted therethrough, with the axle end 11a to receive an end cap 18a turned thereover. A gear spline sleeve 20 clutch end 21 is shown aligned to fit into a driver end 22 of sleeve 12, as shown best in Figs. 2A and 2B, and as is discussed hereinbelow. The gear spline sleeve 20 includes like parallel spaced bars 23 that are fixed longitudinally to the sleeve outer surface 24 and are to receive the contours of the open center of gears fitted thereover as a stack, with a greatest diameter gear preferably arranged closest to the sleeve 12 flange end 13b. A standard bicycle chain, like chain 87 of Fig. 7, is fitted over one of the gears. In operation, the chain 87 of Fig. 7 is moved across the gears, changing the speed of turning of the hub 10 and connected wheel responsive to operation of a derailleur assembly. The hub 10 is assembled by fitting the axle 11 through a center opening formed through roller bearing 17b that, in turn, is fitted in an outer opening 25 of the gear spline sleeve 20. The axle 11 is passed through the gear spline sleeve 20, center sleeve 12, that includes the collar 15, and through the roller bearing 17a, and is to receive the cap 18a turned thereover. A cap 18b, that is like cap 18a, is turned over



the axle end 11b, finishing the assembly of the hub 10 and axle 11 that is then installed to a bicycle frame as the rear wheel.

The hub 10, is assembled as described above, to provide a spring actuated ratchet such that, as shown in Fig. 2A and 2B, and includes an annular ring that is formed with identical spaced teeth 26, as shown in Fig. 1, that are secured to the inner surface of the sleeve 12, adjacent to the sleeve flange end 13b. Shown in Figs. 2A and 2B. each tooth 27 of teeth 26 slopes uniformly outwardly from a based end 28 to an apex wherefrom a flat face 29 extends downwardly. The teeth 26 oppose a number of spaced pawls 30 that are fitted in slots 33 and are spaced to be equidistant from one another and to extend outwardly from around the outer surface of the gear spline sleeve 20 clutch end 21, as shown in Fig. 1. The pawls 30 are each fitted into a slot 33, and a base end of each pawl is mounted at a pivot 32 so as to extend outwardly, under the biasing of sear springs 31, as shown in Figs. 2A and 2B. So arranged, with a wheel mounted to the hub sleeve 12 turning clockwise in a free-wheeling attitude, as illustrated in Fig. 2A, each pawl 31 rides up each tooth 27, extending down the tooth face 29 to engage the next tooth 27 base end 28, with the pawls 31 thereby ratcheted along the teeth 26. When, however, the gear spline sleeve 20 is turned clock-wise, as by action of the bicycle chain 87 acting through one of the gears splined thereon during operation of the bicycle peddle assembly, the pawls 30 outer ends each engage a tooth 27 face 29, as shown in Fig. 2B, locking the gear spline sleeve 20 to the hub sleeve 12, to transfer torque from the peddle assembly to the bicycle wheel.

Like the described torque transferring hub 10, the invention is in a torque transferring hub 40, hereinafter referred to as hub that operates as a clutch for transferring torque into a wheel that the hub is part of. Such torque is generally passed through a chain drive to a gear, illustrated as chain

87 and gears 88 in Fig. 7. Which gear or gears 88 are splined onto a gear spline sleeve 42 that connects, end to end, to a center sleeve 41 whereto ends of wheel spokes are fitted at spaced intervals to extend from around the center sleeve, as shown in Fig. 5. In outer appearance, the hub 40, as shown in Fig. 3, has an appearance that is similar to the prior art hub 10. Shown best in Fig. 4, the hub 40 includes a center sleeve 41 with ends wherefrom flange plates 43a and 43b extend outwardly and are essentially parallel and include, respectively, holes 44 formed at spaced intervals therethrough that are for receiving spoke ends, forming a wheel like the rear wheel 89 of the bicycle 85 of Fig. 7. An axle 45, that is threaded on its ends 45a and 45b, is for fitting through, to hold together, the hub 40 components and to mount the hub 40 to a bicycle rear frame. End caps 46a and 46b are provided that are turned onto the axle threaded ends 45a and 45b to hold the hub 40 together, as set out herein with respect to a description of the assembly of hub 40.

Shown in the exploded view of Fig. 4, and the assembled longitudinal sectional view of Fig. 5, the hub 40 of the invention, like the hub 10, is for fitting onto axle 45. The hub includes the gear spline sleeve 42, that has parallel longitudinal spaced bars 45 projecting outwardly from around a sleeve cylindrical outer surface 46. Which the spaced bars 45 each have a right triangular cross section to accommodate a center hub configuration of at least one, and preferably a stack, of driven gears, like the stack of gears 88 of the bicycle 85, as shown in Fig. 7. The gear spline sleeve 42, shown in Fig. 4, is open therethrough and includes, on an upper end, a threaded end collar 47 for receiving and mounting a ring 48 that is internally threaded at 48a for turning thereover to maintain gears 88 on the gear spline sleeve 42. The collar 50 is fixed to one end section of an axle bearing sleeve 49, just back from a flat circular disk 52 that is treaded to receive an internally threaded lower end of the gear spline sleeve 42 turned thereon. The flat circular disk 52 includes inner face 53 that

contains one of two sides of a torque transfer clutch of the invention, as set out below. The axle bearing sleeve 49 is stepped internally at opposite ends to receive standard roller bearings 55c and 55d, to be fitted therein that are open across their centers to allow passage to and to support the axle 45 fitted therethrough, as shown in Fig. 5.

Shown in Fig. 4, the assembled view of Fig. 5, and Figs. 6A, 6B and 6C, the axle bearing sleeve 49 end that is adjacent to the flat circular disk face 53 is a thick ring 56 having a series of like contoured pockets 57 formed around its outer surface. Each pocket 57 has a forward pocket section 58 formed to seat a ball bearing 59 therein and tapers upwardly from the forward pocket section 58 as a track 58a that the ball bearing 59 will roll along from forward pocket section 58. So arranged, the ball bearings 59 will travel outwardly along the track 58a, when the thick ring 56 is turned in a clock-wise direction. Which turning is provided by a turning of the gear spline sleeve 42 that is turned by a turning of a gear that is splined thereon and whereover a chain, like the chain 87 shown in Fig. 7, is fitted.

Shown in Fig. 4, the center sleeve 41 flange plate 43a, wherein spaced holes 44 are formed that receive ends of spokes fitted thereto, includes a center cup section 60 that is open across a bottom end into an axle passage 61. The center cup section 60 has an adjacent wall 62 that is parallel to the flat circular disk 52 thick ring 56 face, and, when the hub 40 is assembled, will function as the other of the two sides containing the torque transfer clutch of the invention. The center cup section, shown in Fig. 4 and Figs. 6A, 6B and 6C, includes a series of like spaced ring steps 63 as an outside wall 62 of the center cup section 60, and provides a center sleeve 41 annular ring that opposes the contoured pockets 57 of the assembled hub 40. A plurality of ball bearings 59 are shown fitted into the spaced ring steps 63 as they would be positioned when the clutch is engaged to transfer torque

therethrough.

In the assembly view of Fig. 5, the ball bearings 59 are shown fitted into so as to span between the contoured pockets 57 and the ring steps for locking the gear spline sleeve 42 and center sleeve 41 together, transferring torque into the wheel mounted onto the center sleeve 41. This locked state of the gear spline sleeve 42 and center sleeve 41 continues until torque is removed from the gear spline sleeve 42 as when an operator discontinues turning the peddle arrangement with their feet, and allows the wheel 89 to free-wheel. In which free-wheeling, the wheel 89 continues turning in the direction of gear spline sleeve 42 turning, with the ball bearings 59, when not under torque, tending to roll away from the ring steps 63, along the contoured pockets 57 sloping tracks 58a and back into pocket forward sections 58. Which ball bearing 59 travel disengages torque transfer and is essentially immediate when the operator discontinues peddle turning. Likewise, hub 40 engagement is essentially immediate when an operator turns the peddle arrangement to pass the chain 87 around the gear that is connected to the gear spline sleeve 42. It is the gear spline sleeve 42 turning causes the ball bearings 59 to roll back along the contoured pockets 57 sloping tracks 58a and into engagement with engage a ring step 63. As the ball bearings 59 tend to roll in the contoured pockets during free-wheel the engaging surfaces of each of the ball bearings will vary between each engagement, avoiding ball scoring at points of scuffing as has occurred with earlier systems, greatly extending unit life.

Fig. 6A shows the hub 40 in a free-wheeling attitude, the flange plate 43a of the center sleeve 41 turning as illustrated by arrow A, as when the bicycle 85 is coasting and the peddle assembly 86, shown in Fig. 7, is not turning. So arranged, gear spline sleeve 42, whereto is connected the thick ring 56 with the spaced contoured pockets 57 formed therein, is stationary, and the ball bearings 59

rest in the contoured pockets forward sections 58.

Fig. 6B shows the hub 40 of Fig. 6A with arrow B indicating a turning of the gear spline sleeve 42 as through chain 87, that is linked to the peddle assembly 86 of the bicycle 85 of Fig. 7. Which gear spline sleeve 42 is turned, as indicated by arrow B, in the direction of wheel rolling, shown as arrow A in Fig. 6A, and causes the ball bearings 59 to roll oppositely to the direction of turning, traveling upwardly along the sloping tracks 58a to contact a ring step 63 surface. Which ball bearing 59 travel is a very short distance providing essentially an immediate coupling of the respective gear spline sleeve 42 and center sleeve 41 of the flange plate 43a to transfer an applied torque thereacross and turn the wheel 89, shown in Fig. 7.

Figs. 6A and 6B show the cavity between gear spline sleeve spaced pockets 57 and ring step 63 surface as accommodating three ball bearings 59. Whereas, Fig. 6C shows ten ball bearings 59, arranged one in each gear spline sleeve contoured pocket 57. The Figs. 6A, 6B and 6C to illustrate that as few as three and as many as a ball bearing for each pocket 57 can be so used to provide for rapid and sure locking together and separation of the gear spline sleeve 42 of the flange plate 43a and center sleeve 41 for transferring torque from a peddle assembly into a wheel.

Additionally, where Figs. 6A, 6B and 6C all show the gear spline sleeve 42 as including the ring step 63 surface, Figs. 8A, 8B, 8C and 8D are hee included to illustrate other surface configurations of the center sleeve 42 that can be utilized with the described gear spline sleeve contoured pockets, within the scope of this disclosure. Shown in the side elevation view of Figs. 8A, 8B, 8C and 8D, a flange plate 143a has center sleeve surfaces 163a, 163b, 163c and l63d that are opposed, respectively, by gear spline sleeve contoured pockets 157. Which gear spline sleeve contoured pockets 157 are each formed in thick ring 156 that, respectively, include forward pocket



sections 158 that each slope upwardly at 158a so as to accommodate ball bears 159, as shown in broken lines. The center sleeve surfaces 163a, 163b, 163c and 163d, respectively, illustrate alternative surface configuration to the ring steps 63 of Figs. 6A, 6B and 6C, and are herein includes as examples of alternative surfaces capable of engaging and binding to the surface of a ball bearing as is contained in a contoured pocket 57 or 157, of Figs. 6A, 6B and 6C and 8A, 8B, 8C and 8D. Thereby illustrating that the center sleeve surface can be any appropriate surface within the scope of this disclosure.

The above set out description of the components of and function of the hub clutch of the invention for providing a rapid coupling and uncoupling the gear spline sleeve 42 and center sleeve 41 provides for a transfer of road forces as are perpendicular to the road surface. Additionally, the hub 40, for minimizing friction as is directed through the axle 45, and are essentially perpendicular to road forces, preferably includes a thrust bearing 70, as shown best in Figs. 4 and 5, that is installed in the center sleeve 41 center cup section 60. The preferred thrust bearing 70, as shown, has a thin disk shaped body 71 that is open across a center opening 72 to align with the axle opening 61, and with one flat side of the thrust bearing body 71. As shown best in Fig. 5, the thrust bearing 70 is arranged to fit against roller bearing 55b and contact, around its outer section, the wall 62 of the center cup section 61, adjacent to a cavity wherein the roller bearing 55b is seated. Which thrust bearing 70 body 71 other flat side is in contact with roller bearing 55c that is seated in the gear spline sleeve 42 end wherein the thick ring 56 is fitted. So arranged, as shown in Figs. 4 and 5, the thrust bearing 70 includes the thin disk shaped body 71 having center opening 72 therethrough and, in practice, is preferably formed as a sandwich of like front and rear plates 73a and 73b, that are maintained in spaced relationship by both an outer ring 74 and an inner ring wherethrough the center



opening 72 is formed, and which front and rear plates each include radial slots 75. The radial slots 75 are aligned, with each set of aligned slots providing an opening thereacross wherein is journaled a needle bearing 76 that is supported to turn freely therein. So arranged, the described ball bearing clutch 40 provides the described rapid and smooth engagement to transfer torque from a gear or gears splined onto the gear splined sleeve 42 and disengagement, and the thrust bearing 70 minimizes turning friction between the center sleeve 41 gear splined sleeve 42, to efficiently handle axial loads directed therein. While the invention preferably consists of the described hub clutch and thrust bearing arrangement, it should be understood, that the described hub clutch can be used without the thrust bearing 70 within the scope of this disclosure. Also, while the ring steps 63 have been set out herein as a preferred surface for engaging the ball bearings 59 as have traveled outwardly along the sloping track 58a, as described above, other surfaces, such as a scored surface, one with spaced lateral bars or depressions thereacross, or the like, can be so used, within the scope of this disclosure, as illustrated in Figs. 8A, 8B, 8C and 8D, and even a smooth surface could be so used as substitute for the described ring steps 63. Therefore, in practice, it should be understood, any appropriate surface can be so used in addition to the ring steps 63 to provide a surface whereto the ball bearing 59 surface will engage, and bind against, to lock the respective gear splined sleeve 42 and center sleeve 41 together for transferring torque transmitted into the gear splined sleeve 42.

As shown best in Figs. 4 and 5, the hub 40 additionally includes a gear splined sleeve spacer 81 that is fitted over axle 45 and is held in place by lock ring 82a, provides for holding bearing 55d in place, and the center sleeve is shown as including a pair of spacers 83a and 83b that are fitted over axle 45 and includes a lock ring 82b fitted thereto to urge the spacers into the center sleeve end, adjacent to the flange 43b. End caps 46a and 46b are shown turned over the axle 45 threaded ends

45a and 45b, for holding the components together, completing the hub 40 assembly.

The hub 40, as set out above, is suitable for inclusion with a geared or direct drive bicycle, or the like, and a geared bicycle 85 is shown in Fig. 7 as an example of such bicycle. The bicycle 85, as shown, includes a peddle arrangement 86 that is turned to move a chain 87 across one of a stack of gears 88 as are spline fitted over hub 40, turning bicycle wheel 89. Though, it should be understood, another bicycle configuration, other vehicle or machine that is driven as by turning of a peddle arrangement, or the like, could include the hub 40 of the invention, within the scope of this disclosure.

Hereinabove has been set out a description of wheel hub that includes a clutch of the invention that is useful on any vehicle or assembly where a torque is transfered through the hub clutch to turn a wheel, or the like. It should, however, be understood that the present invention can be varied within the scope of this disclosure without departing from the subject matter coming within the scope of the following claims, and a reasonable equivalency thereof, which claims we regard as our invention.

## THE CLAIMS

I Claim:

1. A hub with clutch comprising, a hub body consisting of a first sleeve that includes a means for mounting a driven gear thereon, and a second sleeve that includes means for arrangement as a wheel hub; a hub clutch arranged between said first and second sleeves consisting of a ring section fitted onto an end of said first sleeve and includes identical spaced pockets formed at equal spaced intervals around and into said ring section outer surface, with each said pocket including a deep forward section formed to accommodate a ball bearing fitted therein and each said pocket includes an outwardly sloping surface extending from said forward section to, or near to, said ring section surface, and an end of said second sleeve includes an annular ring section that is adjacent to a cavity wherein said ring section is fitted such that, when said hub is assembled, said spaced pockets oppose an outer surface of said annular ring section, and including ball bearings contained in said pockets to roll from said pocket along said pocket outwardly sloping surface to engage and bind against said annular ring section surface, and with said first and second sleeves including center passages that align to receive bearings for fitting therein that receive an axle fitted through center openings of said bearings; and a straight axle for fitting through said bearings center openings and including coupling means for fitting onto ends of said straight axle for mounting to a frame.

2. The hub with clutch as recited in Claim 1, further including a thrust bearing for installation on the axle between the first and second sleeves that has a disk shaped body that is open through its center to receive said axle, which said body is formed from a pair of like flat disks that each have spaced radial slots formed therein that are aligned to receive needle bearings journaled therein, and including means for maintaining said pair of like flat disks together.

3. The hub with clutch as recited in Claim 2, wherein the thrust bearing is fitted into a cavity formed in the ring section around the center passage formed therethrough, and is sandwiched between the bearings that are fitted, respectively, in the first and second sleeve abutting ends.

4. The hub with clutch as recited in Claim 1, wherein the spaced pockets are identical and each has a cup shape, with said pocket opening to an upwardly sloping surface that extends oppositely to the direction of the ring section when the wheel is rolling forward; and the annular ring section outer surface includes steps formed at spaced intervals therearound for capturing a ball bearing surface as has traveled along the pocket outwardly sloping surface.

5. The hub with clutch as recited in Claim 1, further including bearings formed to receive the axle fitted therethrough that each include an outer race of a diameter to fit in cavities formed in the first and second sleeves ends.

6. The hub with clutch as recited in Claim 1, wherein the first sleeve includes as the means for mounting a driven gear thereon, a plurality of spaced raised longitudinal sections formed around the first sleeve exterior surface that receive a center opening of each gear to allow each said gear to slide over said spaced raised sections and lock thereon.

7. A hub with clutch comprising, a hub body consisting of a first sleeve that includes a means for mounting a driven gear thereon, and a second sleeve that includes means for arrangement as a wheel hub; a hub clutch arranged between said first and second sleeves consisting of a ring section fitted onto an end of said first sleeve and includes identical spaced pockets formed at equal intervals around and into said ring section outer surface, with each said pocket including a forward section formed to have a size and shape to accommodate a ball bearing fitted therein and each said pocket includes an outwardly sloping trough type surface extending from said forward section to,

or near to, said ring section surface, and an end of said second sleeve includes an annular ring section located adjacent to a cavity wherein said ring section is fitted such that, when said hub is assembled, said spaced pockets oppose an outer surface of said annular ring section that includes means for providing a friction surface thereto whereby ball bearings contained in said pockets can roll along said pocket outwardly sloping trough type surface to engage said annular ring section friction surface, and said first and second sleeves include center passages that align to receive bearings fitted therein that receive an axle fitted through center openings that are formed through said bearings; and a straight axle for fitting through said bearings center openings and including coupling means for fitting onto ends of said straight axle for mounting to a frame.

8. The hub with clutch as recited in Claim 7, further including a thrust bearing for installation on the axle between the first and second sleeves that has a disk shaped body that is open through its center to receive said axle, which said body is formed from a pair of like flat disks that each have spaced radial slots formed therein that are aligned to receive needle bearings journaled therein, and including means for maintaining said pair of like flat disks together.

9. The hub with clutch as recited in Claim 8, wherein the thrust bearing is fitted into a cavity formed in the ring section around the center passage formed therethrough, and is sandwiched between the bearings that are fitted, respectively in the first and second sleeve abutting ends.

10. The hub with clutch as recited in Claim 7, wherein the spaced pockets are identical and each has a cup shape, with said pocket opening to an upwardly sloping surface that extends oppositely to the direction of the ring section turning when the wheel is rolling forward; and the annular ring section other surface includes steps formed at spaced interval therearound as the friction surface for capturing a ball bearing surface as has traveled along the pocket outwardly sloping

surface.

11. The hub with clutch as recited in Claim 7, further including bearings formed to receive the axle fitted therethrough that each include an outer race of a diameter to fit in cavities formed in the first and second sleeves ends.

12. The hub with clutch as recited in Claim 7, wherein the first sleeve includes a plurality of spaced raised sections formed as spaced longitudinal sections formed around the first sleeve exterior surface that are to receive one or more gears, each having a center opening to slide over said spaced raised sections, each said gear and lock thereon.

13. A hub with clutch comprising, a hub body consisting of a first sleeve that includes a means for mounting a driven gear thereon, and a second sleeve that includes means for arrangement as a wheel hub; a hub clutch arranged between said first and second sleeves consisting of a ring section fitted onto an end of said first sleeve and includes identical spaced pockets formed at equal spaced intervals around and into said ring section outer surface, with each said pocket including a deep forward section formed to accommodate a ball bearing fitted therein and each said pocket includes an outwardly sloping surface extending from said forward section to, or near to, said ring section surface, and an end of said second sleeve includes an annular ring section adjacent to a cavity wherein said ring section is fitted such that, when said hub is assembled, said spaced pockets oppose an outer surface of said annular ring section whereby ball bearings contained in said pockets can roll along said pocket outwardly sloping surface and engage, to bind against, said annular ring section surface, and said first and second sleeves include center passages that align to receive bearings fitted therein that receive an axle fitted through center openings of said bearings; a bearing means fitted between said first and second sleeves for minimizing load forces directed across said first and second



sleeves; and a straight axle for fitting through said bearings center openings and includes coupling means for fitting onto ends of said straight axle for mounting to a frame.

14. The hub with clutch as recited in Claim 13, wherein the bearing means fitted between the first and second sleeves is a thrust bearing for installation on the axle between said first and second sleeves that has a disk shaped body that is open through its center to receive said axle, which said body is formed from a pair of like flat disks that each have spaced radial slots formed therein that are aligned to receive needle bearings journaled therein, and including means for maintaining said pair of like flat disks together.

15. The hub with clutch as recited in Claim 14, wherein the thrust bearing is fitted into a cavity formed in the ring section around the center passage formed therethrough, and is sandwiched between the bearings that are fitted, respectively, in the first and second sleeve abutting ends.

16. The hub with clutch as recited in Claim 13, wherein the spaced pockets are identical and each has a cup shape, with said pocket opening to an upwardly sloping surface that extends oppositely to the direction of the ring section when the wheel is rolling forward; and the annular ring section outer surface includes steps formed at spaced intervals therearound for capturing the surface of a ball bearing as has traveled along the pocket outwardly sloping surface.

17. The hub with clutch as recited in Claim 13, further including bearings formed to receive the axle fitted therethrough that each include an outer race of a diameter to fit in cavities formed in the first and second sleeves ends.

18. The hub with clutch as recited in Claim 13, wherein the first sleeve includes, as the means for mounting a driven gear thereon, a plurality of spaced raised sections formed as longitudinal sections formed around the first sleeve exterior surface that are to receive a center

opening formed through a gear or gears that are to slide over said spaced raised sections and lock thereon.

### ABSTRACT OF THE DISCLOSURE

A wheel hub with clutch for a bicycle, other transport vehicle or machine where power is transferred through a drive, such as a chain that is linked between a peddle arrangement and a gear or gears splined onto the hub. The hub provides free-wheeling when a torque is not applied thereto, and will instantly engage, transferring an applied torque therethrough and into a wheel connected to the hub. To provide which torque transfer the hub is free-rolling in a clock-wise or forward turning direction, but will lock to transfer torque therethrough, and turns also in a clock-wise direction when torque is applied as through a peddle arrangement. For locking, the hub includes, as a radial load bearing component, a sleeve whereon a gear or gears are splined, with the splined gear sleeve mounting a thick ring for fitting into an end of a wheel sleeve. The thick ring contains spaced apart counter clockwise sloping pockets, each for containing a ball bearing, and the wheel sleeve includes an annular ring that receives the thick ring fitted there and has spaced steps, or the like, formed therein to engage the ball bearing surfaces, transferring torque. With the hub preferably further including a thrust bearing arranged between the thick ring and center sleeve.

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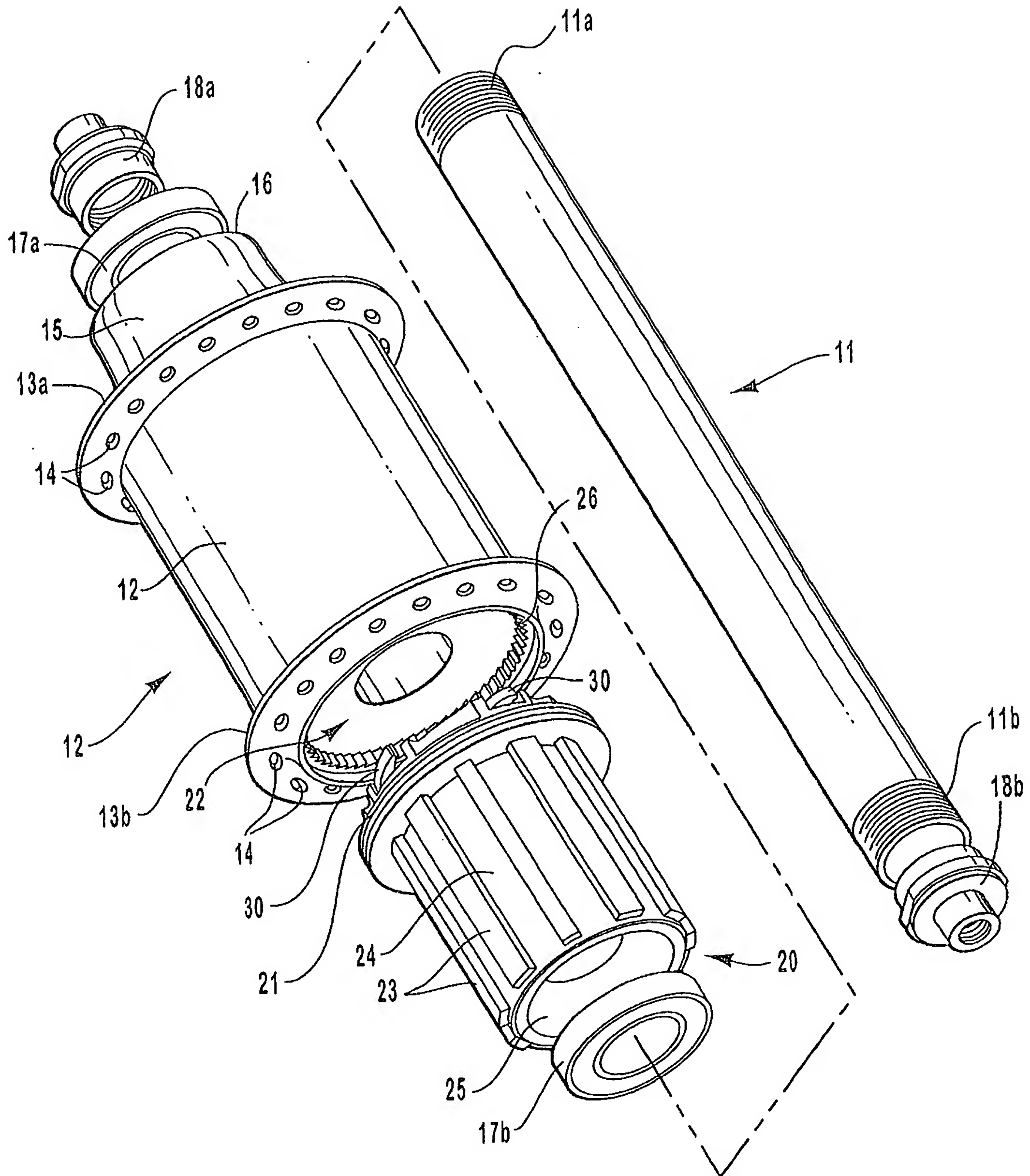


FIG. 1  
(PRIOR ART)

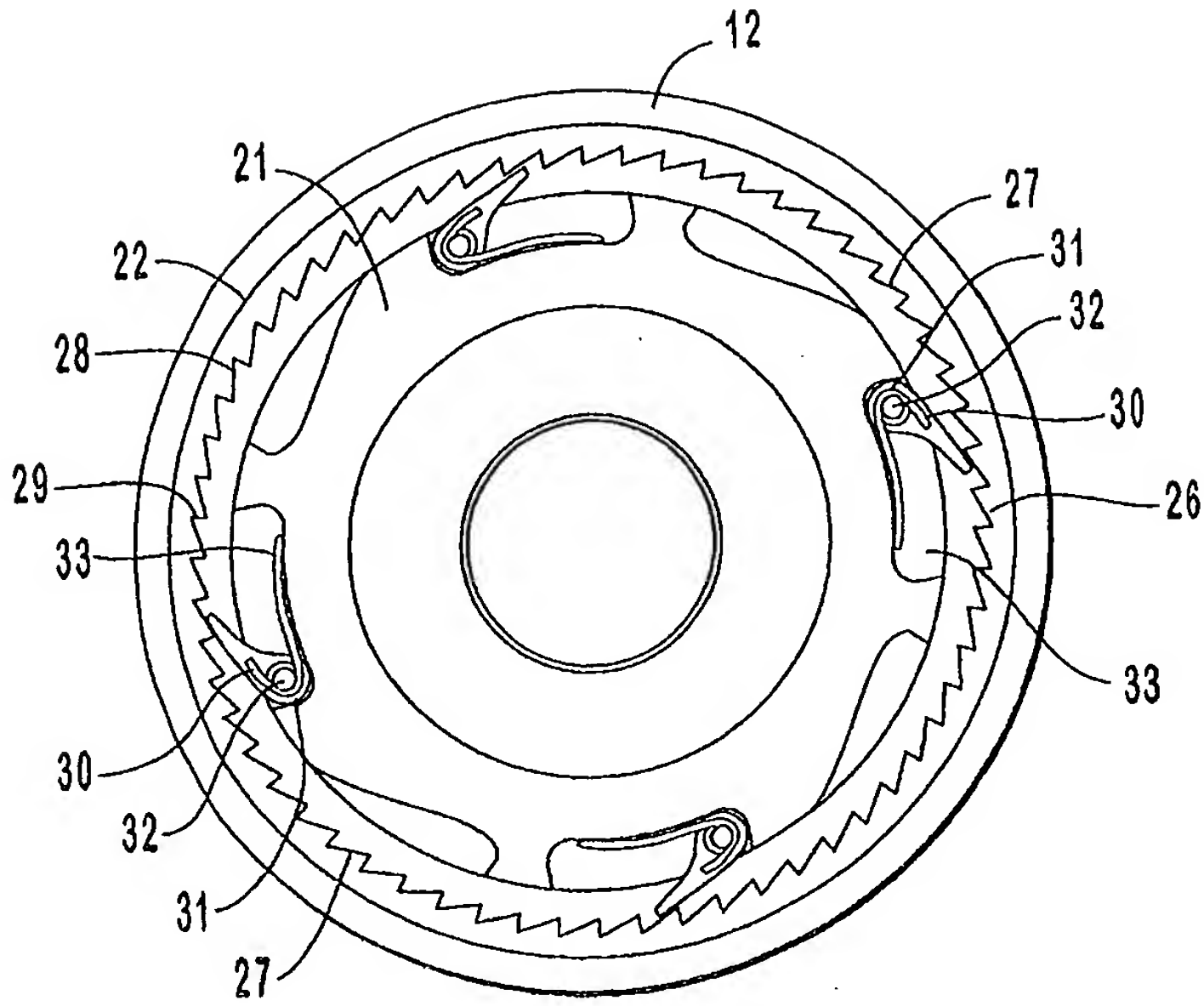


FIG. 2A  
(PRIOR ART)

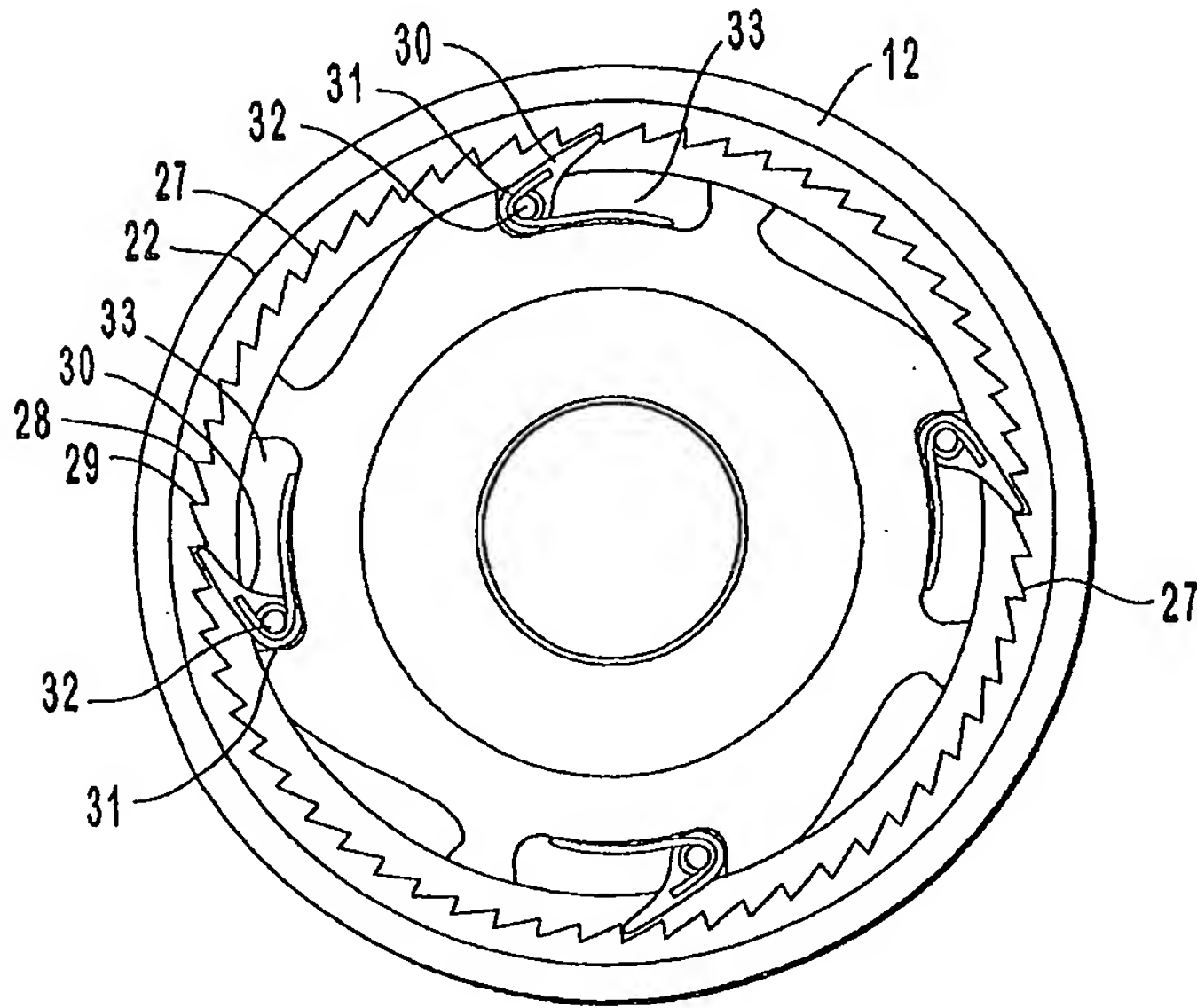


FIG. 2B  
(PRIOR ART)

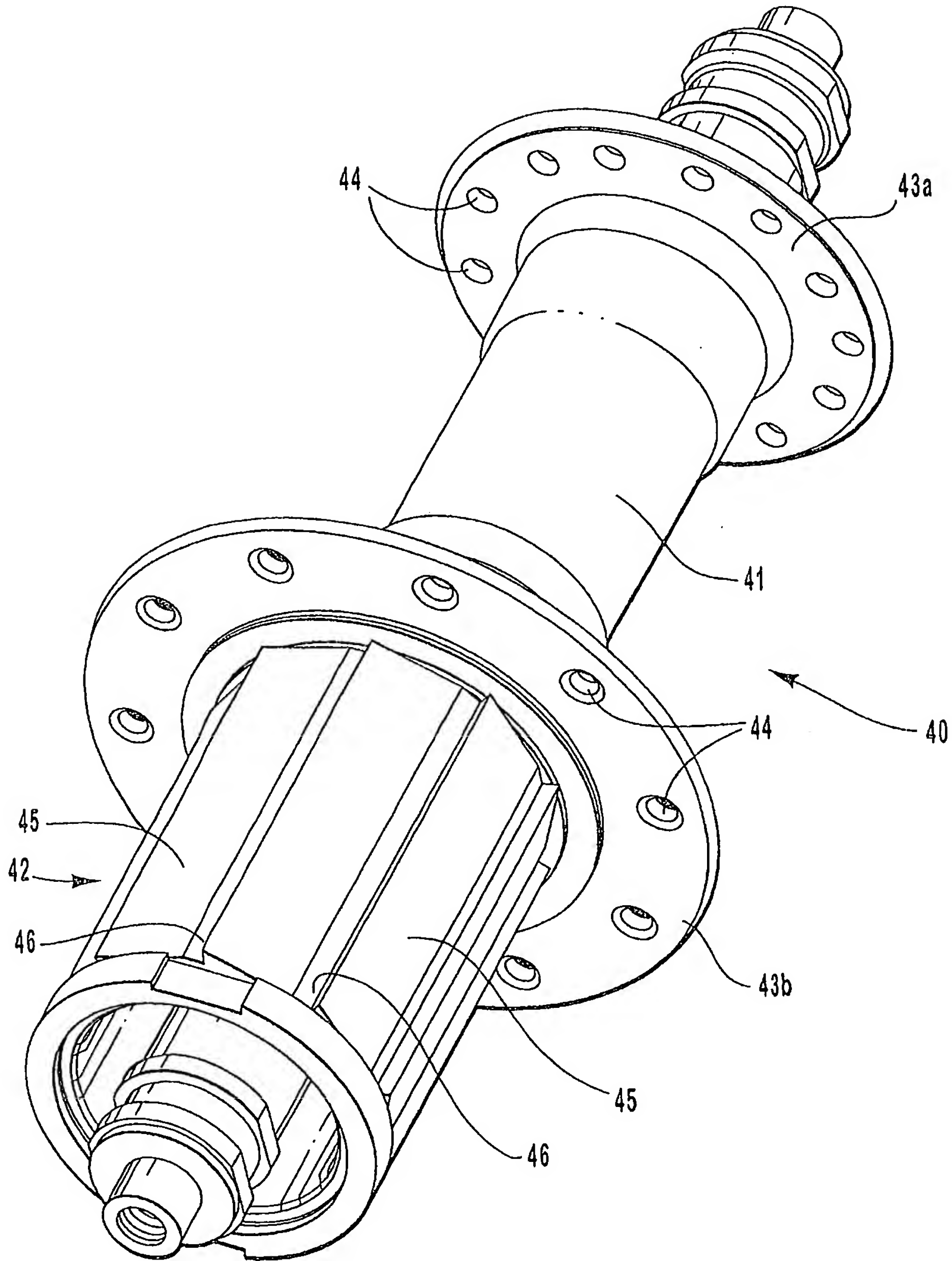


FIG. 3





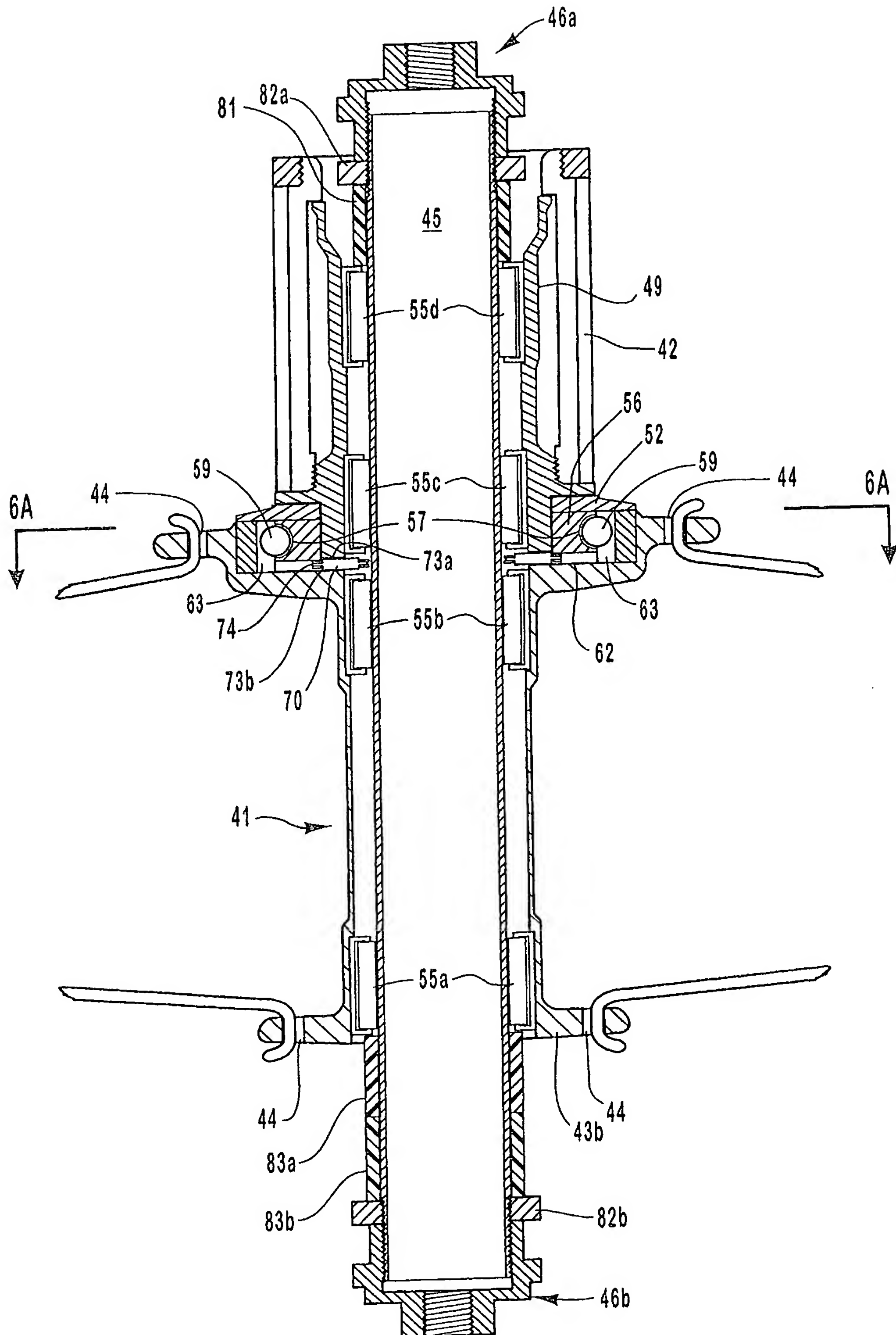


FIG. 5

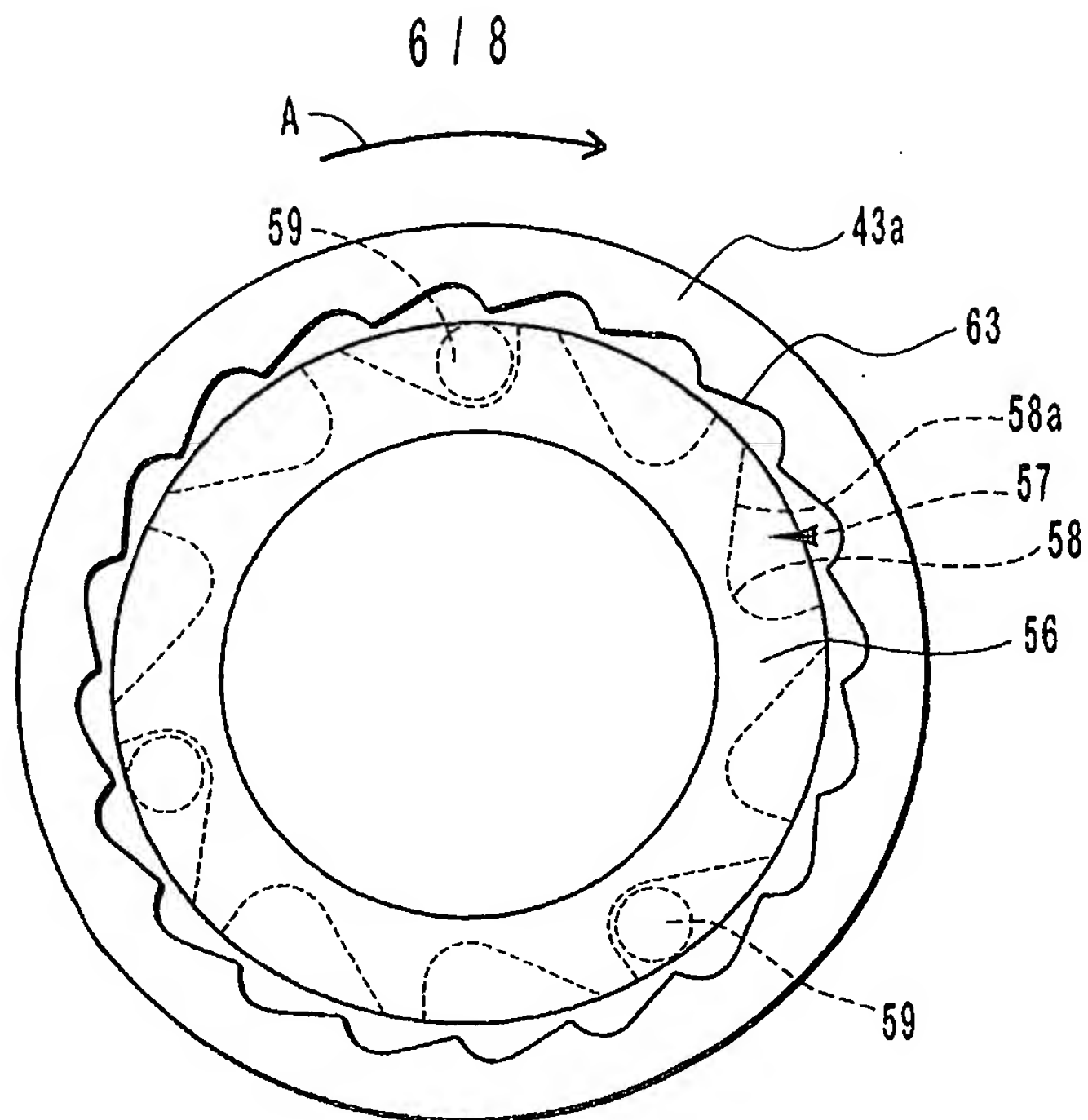


FIG. 6A

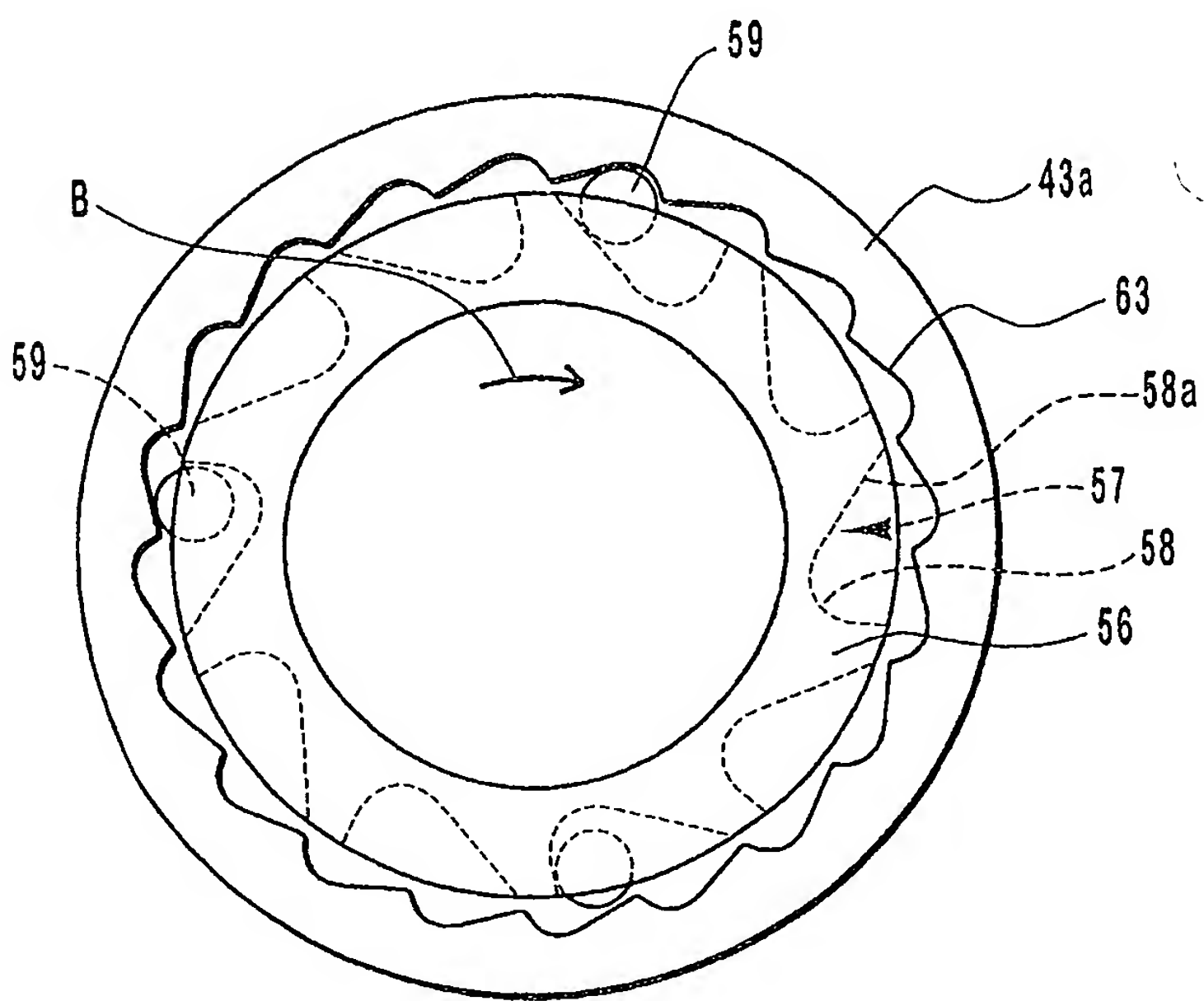


FIG. 6B

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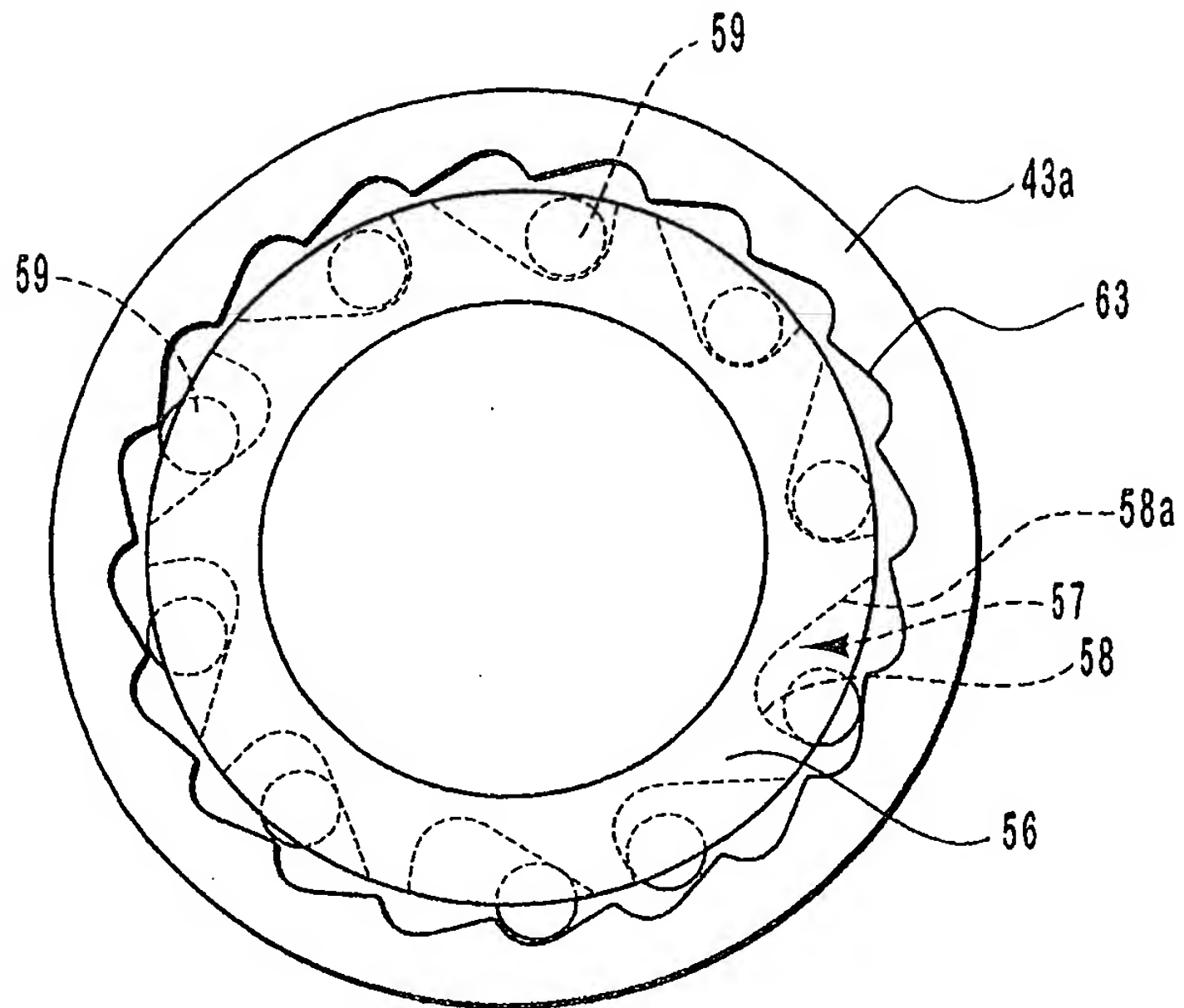


FIG. 6C

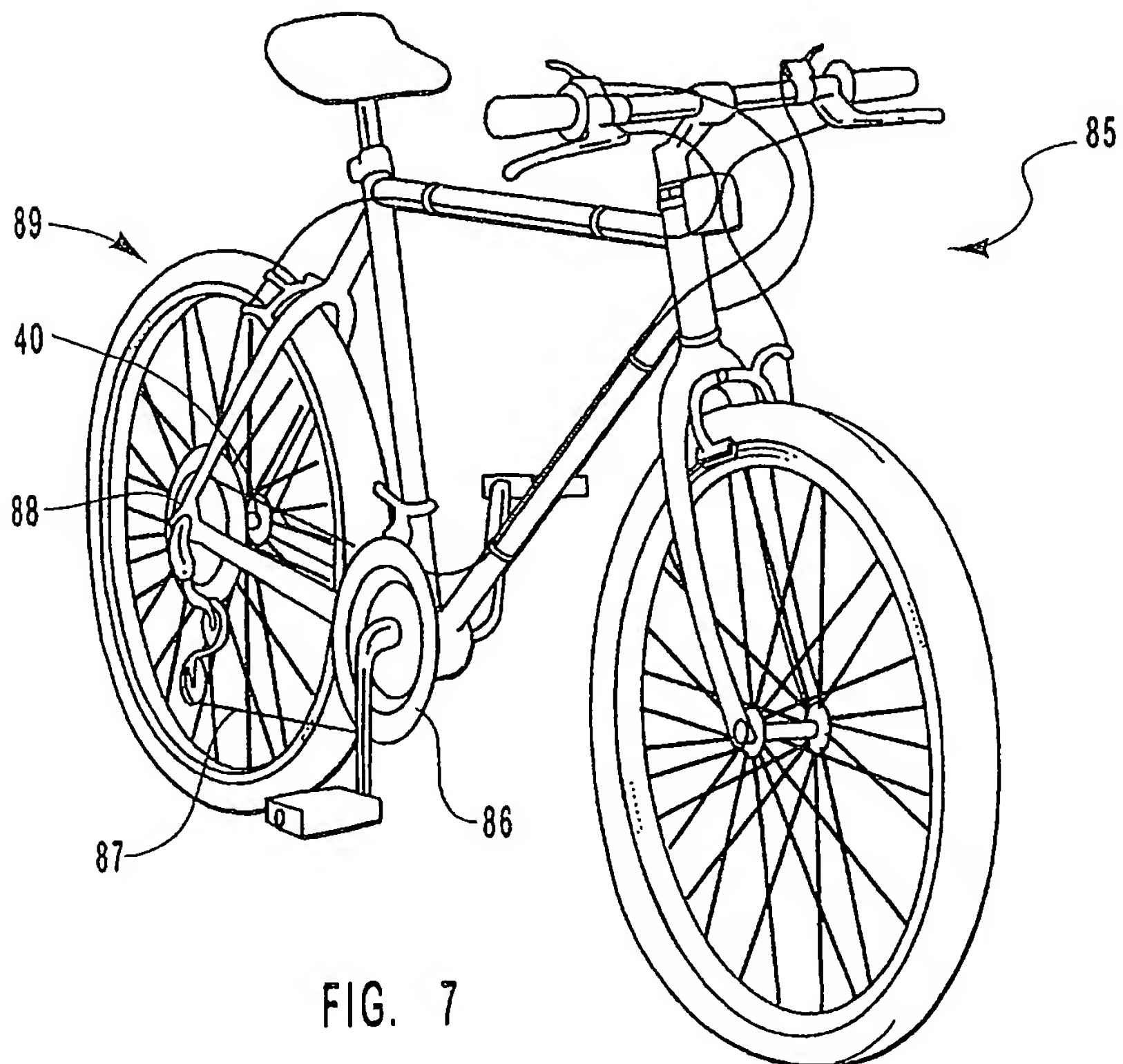


FIG. 7

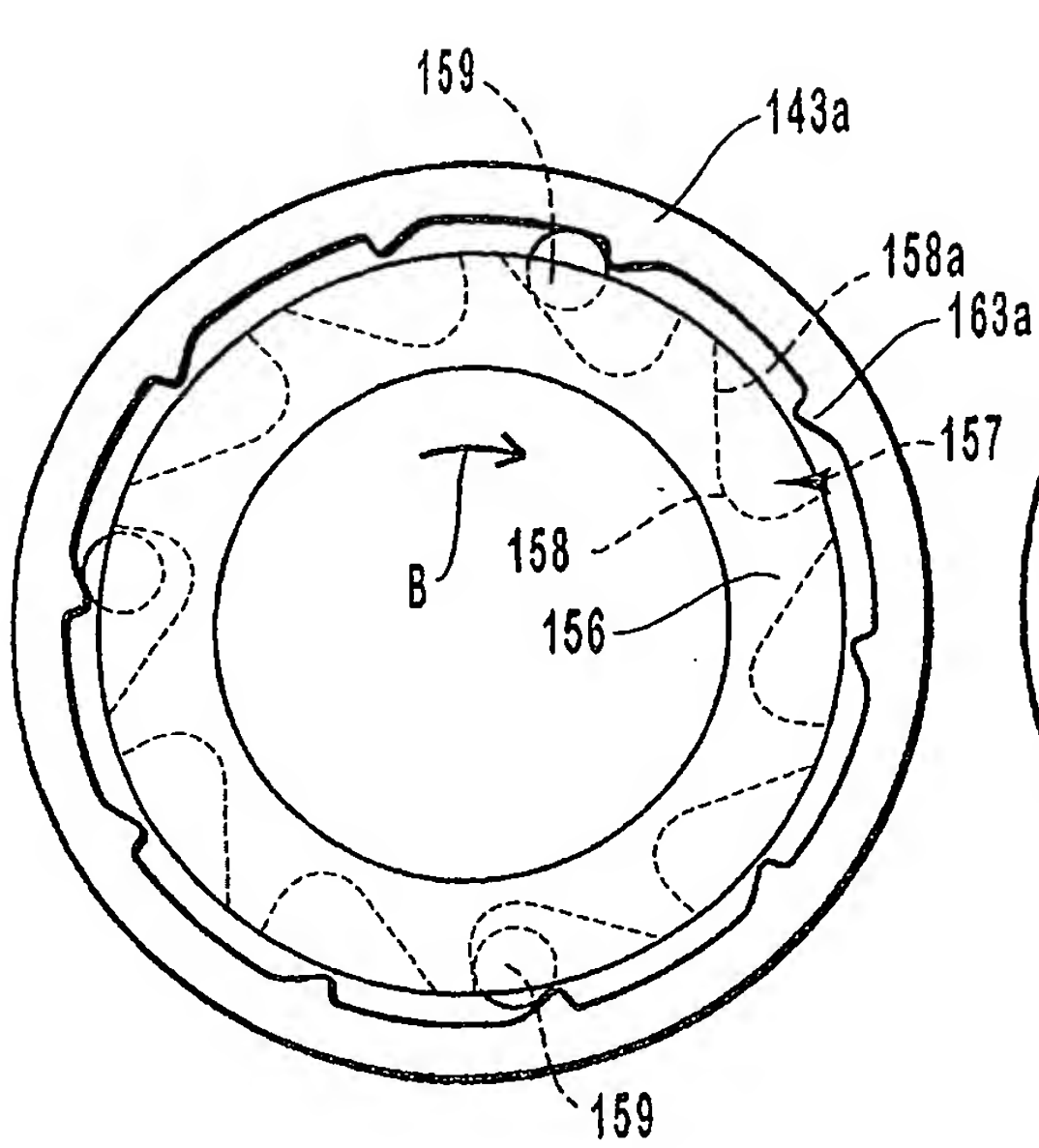


FIG. 8A

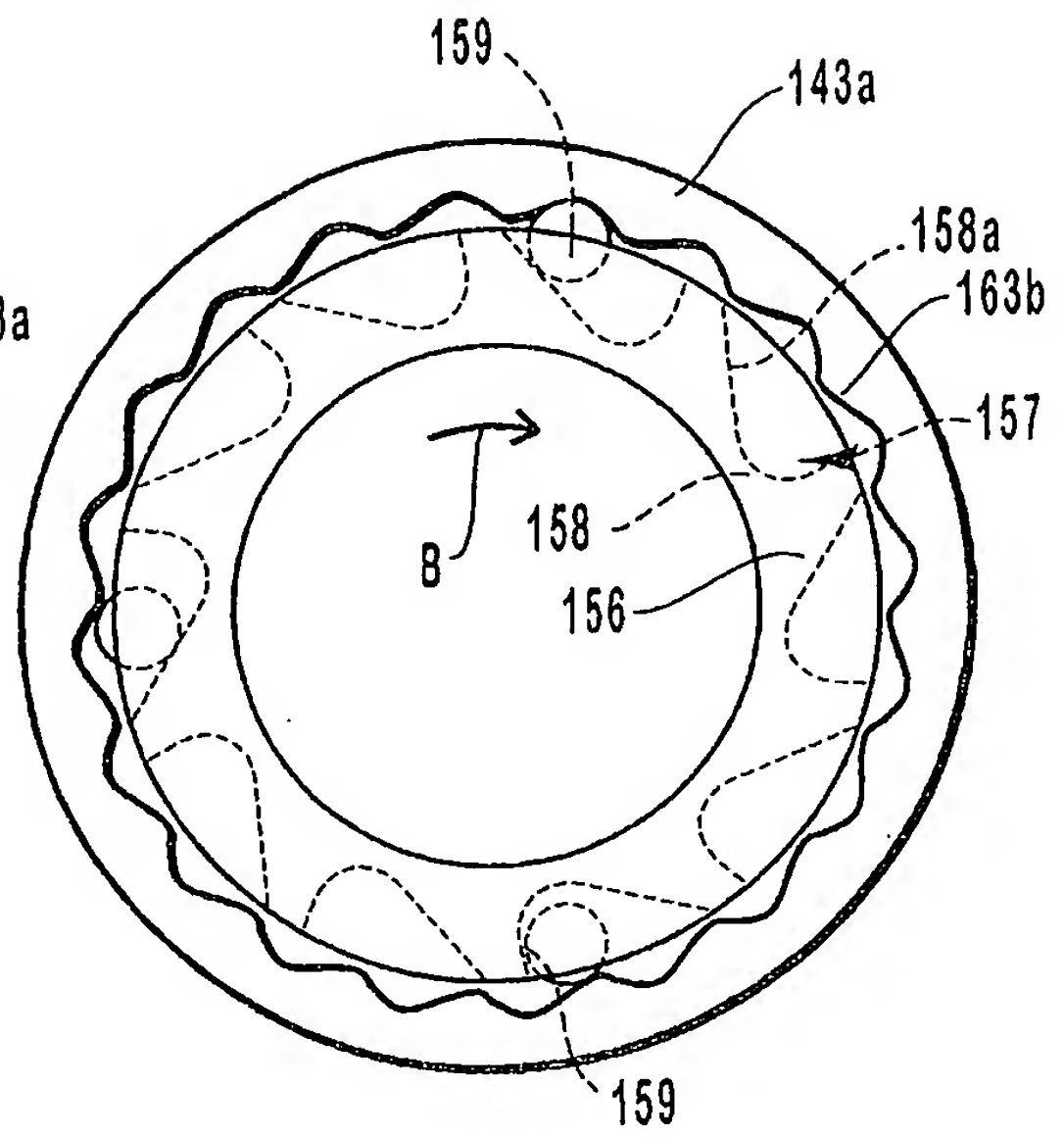


FIG. 8B

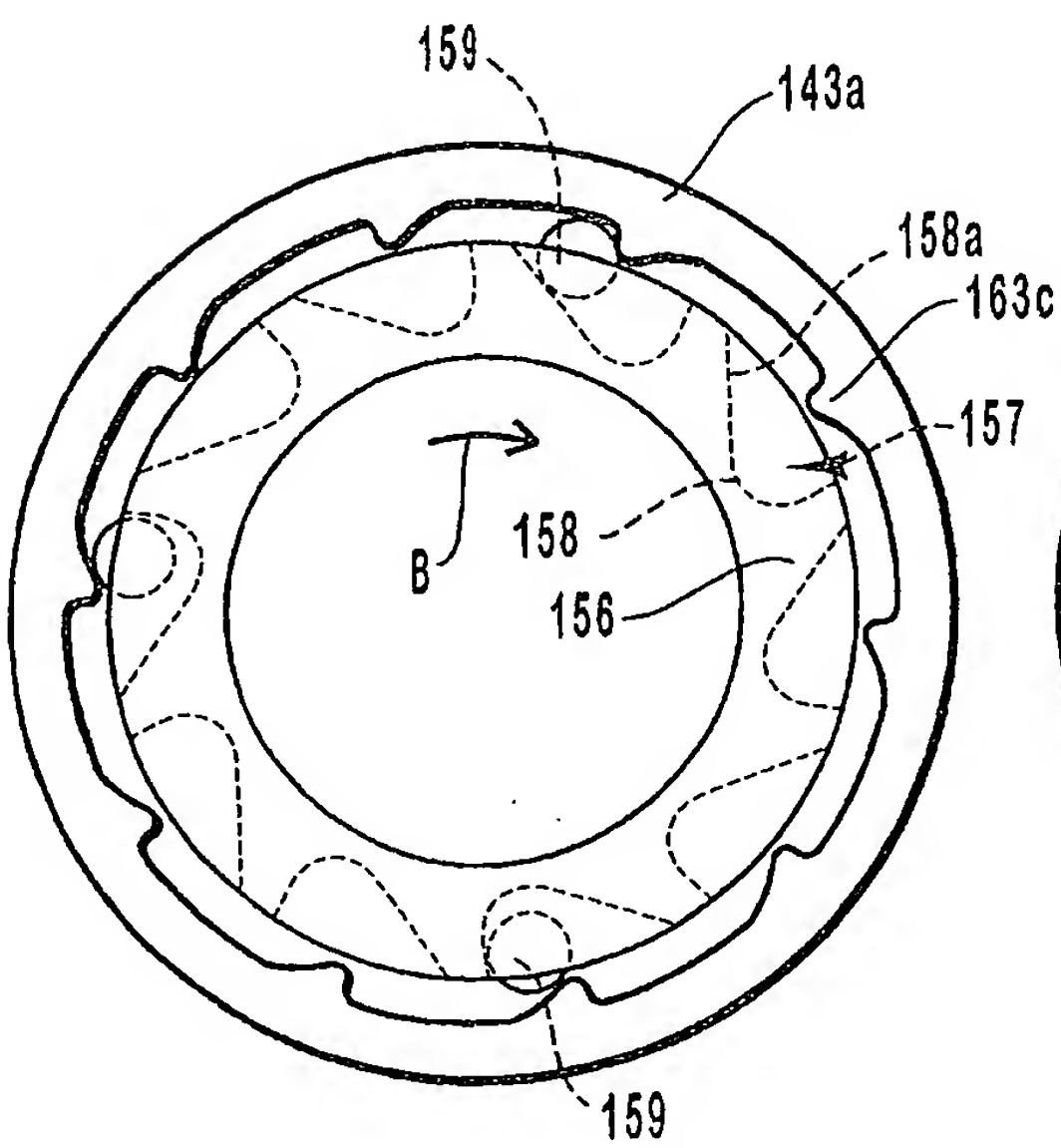


FIG. 8C

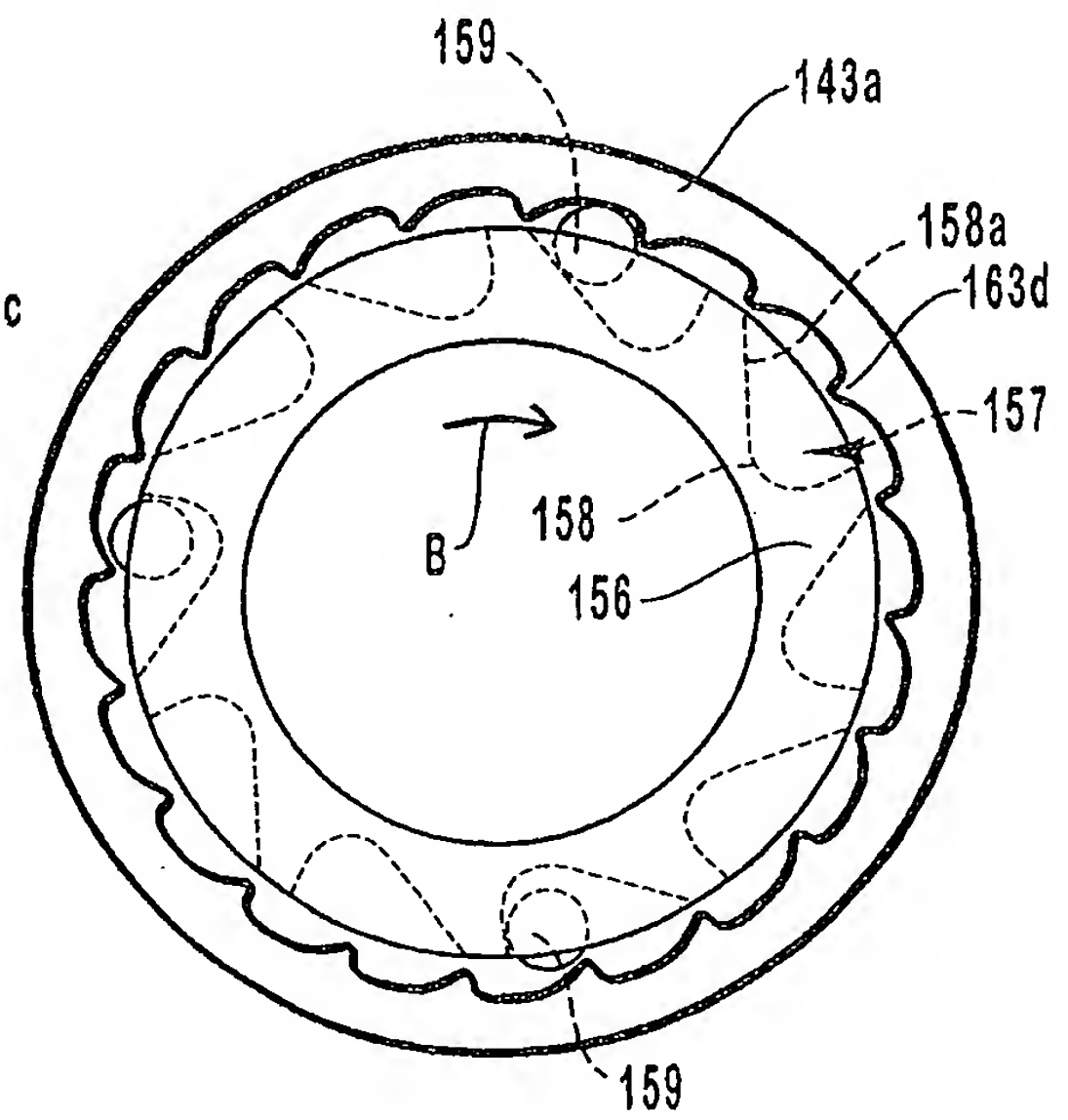


FIG. 8D